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ADVANCED MATERIALS

Germany Approves Computerized Light Metal Alloy Research

90WS0097B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 7 Sep 19 p 8

[Article: "Increasing European Efforts in Materials Research—Development of a Date Base for Alloys Moving Ahead—Funds From Bonn"]

[Text] re. Bonn, 6 Sep. The establishment of a data base to develop new light metal alloys which was agreed on in the fall of 1989 is making progress as part of the "European Cooperation in the Area of Scientific and Technical Research." Recently, the federal minister for research and technology has approved nine German projects with funds totalling DM3.1 million.

For many technical applications, the combination of specific weight and adequate strength is the major factor determining the suitability of a material. Light metal alloys based on aluminum, titanium, and magnesium have long been favorites, in particular in the aircraft and automobile industries. Increasingly stringent requirements for material and component properties such as improved heat resistance, better resistance to fatigue, corrosion and wear, have led to intensified efforts in materials research. Therefore, the federal ministry for research and technology is funding numerous promising materials and process developments as part of the materials research program.

The light metal alloys contain up to eight different alloy methods. Considering stable or metastable phases, the possible variations such as chemical composition and heat treatment are almost limitless. A conventional experimental study of phase equilibriums of all systems with potential industrial application is, however, too time consuming and expensive. One solution is to let the computer do the calculations based on thermodynamic data. In combination with a limited number of experimental measurements, this "thermodynamic concept" constitutes a cost effective tool for researchers and engineers. This method is currently being used for two-component systems. However, its application in systems with three and more components has just started. Increased European research and development efforts will be necessary in order to develop new multi-component systems for industrial applications within a reasonable time frame and at a reasonable cost. As a first step, research is being done on light metal alloys based on magnesium, aluminum and titanium. These materials are prime candidates for innovative applications in lightweight construction, in the aerospace industry and in transportation.

Fraunhofer Designs Automated System for Fiber Composites

90WS0086A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 14 Aug 90 p 8

[Article: "A Robot for Processing Fiber Composites: A Fraunhofer Design of a Highly Flexible System for Semi-Manufactured Products and Component Geometries"]

[Text] Aachen, 13 Aug—A system for production of components made of long-fiber-reinforced synthetics has been developed by the Fraunhofer Institute for Production Technology (IPT). This is a system design which provides great flexibility in its application in winding and tape positioning processes with regard to the use of semi-finished products and component geometries. The basis of this system, installed under the direction of Prof Dr. Manfred Weck, is a six-axis portal robot modified for processing and machining of fiber composites and enhanced with the necessary peripherals.

Because of low rigidity the portal robot can only be used to a limited extent for machining synthetic fiber composite components. However, machining units are under development with which simple operations such as drilling, trimming, and light cutting tasks can be performed. Whereas fiber composites are widely used in aircraft manufacture, they are only slowly gaining acceptance in auto manufacture and mechanical engineering.

One reason for this, according to Manfred Weck, is the lack of production systems with which components of high technical quality can be made both reproducibly and cost effectively. Until now, component production has been characterized by great deal of manual work. This is particularly true for components which are flat, spherical, or not rotationally symmetric. In contrast to the situation in aviation and space, it is first necessary to develop suitable processing and machining equipment. The IPT is working within the framework of the special research area concerned with development of cost effective production machines.

Of the processing activities for fiber composites, winding and tape positioning procedures are particularly well suited for long-fiber processing. The functional suitability of components produced in the winding and tape positioning procedures depends on the orientation of the fibers in the composite. The complexity of the calculation algorithms for dimensioning such parts and the necessity for extremely accurate production make automation of the fiber composite design and production process essential.

The production system at the Fraunhofer Institute in Aachen is equipped during its first developmental period with a processing unit of the portal robot. Later, two autonomous robots are to be available to provide simultaneous production capability for components in the winding and tape positioning procedures. With its basic

equipment, the portal robot has six NC axes. Of these, three axes are designed as translational axes. The hand axes are rotational axes. Using these six axes, manipulation devices or tools attached to the robot hand can be arbitrarily positioned and oriented.

The winding unit, whose axis of rotation is designed as an NC axis, is integrated into the working area of the robot. It permits fabrication of rotationally symmetric components as well as complex solids, such as T-pipes. In addition to the winding unit, the portal robot includes a tape positioning station. Currently, the parts to be produced in the tape positioning process can only be loaded from above. In order to position the parts all around, a two-axis turntable is to be installed in the working area of the robot.

The robot control is from Siemens. It is a Siemens Sirotec RCMIII which can drive a maximum of six primary axes and two additional axes synchronized with them under continuous-path control. This is necessary both in tape positioning and in winding with the portal system to obtain the required accuracy.

For use in the portal robot, the control was equipped with both options of sensor function and DNC and Irdata interfaces. The sensor function is necessary for control of the tape positioning head over complex paths; the DNC and Irdata functions handle communications between the robot controller and external computer systems. This includes the capabilities for automation measures, such as off-line programming which is essential for reproducible production quality with high cost-effectiveness.

This design for a flexible production system for fiber composite components developed at the Fraunhofer Institute for Production Technology points the way to a transition from the custom designs for a very limited spectrum of components available to date to versatile production. The component size flexibility obtained, the production changeover capability, and the preparation of semi-manufactured products enables the manufacturer to react more quickly to altered market conditions.

With the portal system, a group of components of varied cross-sectional shapes (cylinder, rectangle, oval) and of lengths between 100 and 2800 mm has already been produced in the winding process. This clearly demonstrated the advantages of the flexible design. Continued research activities will focus on increasing cost-effectiveness through accompanying automation measures.

The capacity for rationalization of the production of fiber composite components depends to a critical extent on the degree of automation possible in production cycles. Consequently, a fundamental task involves the creation of the system components and data processing conditions essential to production of fiber composites. Plans are being developed for a tool changing system, a component core changing system, and a palletization system for linking the forming stations to the downstream hardening stations.

Automation represents a central emphasis of this research project within the framework of cost-effective production with reproducible high product quality. A design for networking the robot control with external computer systems to form a CAD/CAM link is currently under development.

Cost Light Metal Alloy R&D Program Gets Under Way

91MI0005 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 31 Aug 90 p 10-11

[Text] The establishment of a data base for developing new light metal alloys (COST project 507), agreed on in the fall of 1989 under the European Cooperation on Scientific and Technical Research (COST) program, is now imminent.

The Federal Minister of Research and Technology has approved nine German projects with total subsidies amounting to DM3.1 million.

The specific weight and adequate strength of the materials used play a dominant role in many technical applications. Light metal alloys based on aluminum (Al), titanium (Ti), and magnesium (Mg) have long occupied a central position in this field, especially in the aviation and motor vehicle industries. The ever-increasing requirements set for materials and component properties in terms of, for example, improved thermal stability and better fatigue, corrosion, and wear resistance, have spurred materials researchers on to greater efforts. For this reason, the Federal Ministry of Research and Technology is also subsidizing numerous promising material and process developments in this field under its materials research program.

Technically relevant light metal alloys involve up to eight different alloying methods. The possible variations in, for example, chemical composition and heat treatment, are practically unlimited as regards stable or metastable phases. However, a conventional experimental phase equilibrium study of all systems with potential industrial interest would be too time-consuming and to costly. Computer calculations based on thermodynamic data provide a solution here. Used in conjunction with a limited number of experimental measurements, this "thermodynamic concept" represents a cost-effective tool for researchers and engineers. This process has already been introduced in binary alloy systems. However, we are still at the beginning in ternary and multialloy systems. Greater research and development efforts are needed at the European level to develop new, industrially relevant multialloy systems within a reasonable time and cost framework. A start has been made with magnesium-, aluminum-, and titanium-based light metal alloys. These materials have an especially

high innovation potential in lightweight construction, aerospace, and the traffic and transportation sectors.

The reaction from COST member countries has been favorable. The following countries are taking part (the figure in brackets refers to the number of projects presented): Austria (4), Belgium (3), FRG (9), Spain (2), France (3), Greece (2), Italy (1), Norway (1), Portugal (2), Sweden (2), Finland (1), and the United Kingdom (1).

Prof. Guenther Petzow, from the MPI [Max Planck Institute] of Metal Research, Stuttgart, has been elected chairman of the international administrative committee. The administrative committee secretariat is provided by the Commission of the European Communities in Brussels.

The basic experimental and theoretical studies will be carried out at

the institutes of the Rhine-Westphalia Technical University in Aachen, the University of Stuttgart, and the MPI of Metal Research in Stuttgart, and will be accompanied by applications-oriented work in the research institutes of the Vereinigte Aluminium Werke [United Aluminum Works] in Bonn and the Mannesmann Roehren Werke [Pipe Works] in Duisburg. Industry is also providing numerous pointers for the choice of alloys. There is close information exchange between COST project 507 and the other COST projects studying light metal alloys.

Further information is available from the Materials and Raw Materials Research Project Management at the KFA Research Center Juelich GmbH, P.O. Box 19 13, 5170 Juelich.

Italy: Crack Measuring System for Metals Developed

90MI0363 Milan CISE NEWSLETTER in Italian Jul 90 p 4

[Text] CISE [Center for Data, Studies, and Experimentation] has developed a system to measure the depth of cracks in metallic materials. This system is based on a project by General Electric Corporate R&D in Schenectady, New York. The system uses the accurate readings of the drop in electrical potential obtained from samples when a current travels through these. This system is one of the pieces of equipment found in CISE's laboratories, which carry out advanced tests on the characterization of materials: resistance to fracture, corrosion, stress cracking, fatigue, and creep.

The characteristics of the system, which is called Reversing Direct Current Electrical Potential Drop (RDCEPD,) are the following:

- a direct current power supply with an intensity of approximately 10A;
- a periodic inversion of the current's polarity (in practice, power cycles with square waves and a 1 cmp frequency) to evaluate and consequently eliminate thermoelectric potentials on the measurement circuit from the voltage measurements;
- the use of reference potentials to obtain relative measurements that are not affected by inevitable fluctuations in current and temperature.

The values of electrical potential are collected in real time and are digitalized and sent to a PC for further processing. The software developed at CISE makes it possible to carry out the entire measuring process automatically. The activated functions are: a command to invert the current's polarity, scanning the potential, providing the averages of samples, calculating the length of the crack on the basis of previously known calibrations, which are a function of the geometry of the samples alone but are not related to external parameters such as temperature, the intensity of the current used, the type of material in the sample, etc.

In addition to internal tests, the RDCEPD system can be used on the field to analyze the integrity of products and components. Typical measurements involve components in use, with the possibility of direct on line monitoring and determining the actual shape of the cracks (long cracks going in both directions of the plane).

The system was developed to monitor the growth of defects in laboratory samples and can be applied to components during use, even at very high temperatures. Once a crack has been found with traditional nondestructive controls, even if it is buried within the material, measurements of potential are made in different points of that area. By processing the data on a computer, the three-dimensional shape of the crack that caused the distribution of sample potentials can be traced.

The method described is currently the only method capable of accurately monitoring the propagation (with a resolution of a few micrometers) of cracks in components during their use, and can be applied to all conducting materials (steels, nickel and aluminum alloys). The system even operates by remote control (a data collection unit hundreds of meters away from the component being sampled) without any appreciable loss of precision.

AEROSPACE, CIVIL AVIATION

European Optical Space Communications System Developed

91P60032A Berlin NACHRICHTENTECHNIK ELEKTRONIK in German Oct 90 p 362

[Text] Within the framework of the ESDA-PSDE program, a group of European firms has developed an experimental communications system for studying the feasibility and capacity of an optical communications link between satellites. The configuration consists of two optical terminals: (1) the GEO terminal aboard the ESASAT-2 satellite and (2) the LEO terminal aboard the French SPOT IV earth observation satellite. The system

is firstly an interorbit link (IOL), a system for linking up satellites in space. It is to serve especially the future European data satellite system, EDRS. The communications system is based upon the use of GaAlAs laser diodes which function as transmitters at wavelengths between 0.8 microns and 0.85 microns. These components set up continuous wave operation at a power rating of 30 mW and are directly modulated in an injection current. From among several modulation techniques, quaternary pulse position modulation (QPPM) has proven to be the optimal technique. Direct demodulation on the receive side is carried out using highly sensitive silicon avalanche photodiodes (Si-APDs). The transmission capacity is 65 Mbits/sec for a bit error rate of less than one in a million, over ranges of 45,000 km. With the aid of wavelength multiplexing technology, the transmission capacity can be increased many times. The acquisition and tracking gear gives an exact alignment of a very narrow transmitting beam, with an accuracy of around 0.35 seconds of arc.

Ariane 5 Program Status, Plans Outlined

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 24 Aug 90

[Article: "First Launch Planned for 1995, Conversion Cost in French Guiana Estimated at DM3 Billion"]

[Text] Frankfurt, 23 August. The development of the world market for commercial space transport systems and the success to date of the Ariane rocket have provided a solid basis for the European space industry. Market studies on the future need for commercial payloads indicate an increase in satellite weights and increased competition. With the new Ariane 5 rocket, Europe will create a powerful vehicle by the mid-nineties. The European Space Agency (ESA) estimates the development costs for the Ariane 5 at DM8.2 billion.

In spite of the high launch rate foreseen for the European market over the next 25 years, the Ariane 5 rocket is not designed as a reusable system; that would have greatly increased the development cost. The Ariane 5 has a launch weight of 540 metric tons and a payload capacity of 21 metric tons for a low-earth equatorial orbit. These figures put it in the same performance class as the American Titan 4 rocket or the Soviet Proton vehicle. With its high-energy central stage and two solid-fuel boosters on the side, the Ariane 5 has a certain similarity to the American space shuttle. However, the Hermes space shuttle sits atop the Ariane rocket while the shuttle orbiter is mounted on the side of the main tank.

The central stage of the new European Ariane 5 rocket consists of a cylindrical tank that is 30 meters long and 5.4 meters wide. In this tank, 155 metric tons of the high-energy fuel combination of liquid hydrogen and oxygen are burned in 10 minutes. This burn uses a rocket of the HM-60 (Vulcan) type providing a thrust of 104 metric tons. The two solid fuel boosters mounted on the side operate during launch. These boosters are each 30 meters long and have a diameter of three meters. Each booster weighs 270 metric tons. The auxiliary launch rockets provide a thrust of 1300 metric tons for two minutes. The payload of one to three satellites is launched into a geosynchronous orbit using a small, powerful upper stage that is also 5.4 meters wide. Up to three satellites of the new performance class can be carried simultaneously beneath the payload protective hood in the Speltra structure. This hood is up to 20 meters high.

The new Ariane launch facility ELA-3, located near the two complexes ELA-1 and 2 used to date, also consists of several complexes and the actual launch pad with extensive road and rail connections. One unusual feature of the new launch complex ELA-3 is the incorporation of production facilities for the solid-fuel rocket boosters. These boosters provide Ariane 5 with the necessary launch thrust.

Transporting the booster segments together with the paste-like fuel mixture from Europe to South America would be too complicated and too dangerous. For this reason, only the cylindrical steel housings are shipped. A special facility in Kourou then fills these housings with the fuel. All development tests for the solid-fuel boosters and the final burn qualification tests for the Vulcan main engine of the Ariane are run on special test stands in French Guiana.

The cost for the entire start facility of the new European Ariane 5 rocket is estimated at DM3 billion.

Conversion of the ELA-2 complex with fuel tanks: DM121.1 million

Ariane 5 booster test stand: DM90.1 million

Booster fuel production: DM303 million

Ariane 5 launch complex: DM757.6 million

Fuel production facility: DM90.9 million

Miscellaneous facilities: DM15.5 million

Modification for existing facilities: DM212.1 million

Connecting street/rail line: DM60.6 million

90-kV power plant: DM636.4 million

Infrastructure in Guiana: DM606 million

Total: DM3029.3 million

Kourou is only five degrees north of the equator. This gives it the most favorable geographic position of all rocket launch sites in the world. Here, the rotational speed of the earth of 460 meters per second in a west-to-east direction can be fully exploited for accelerating the rockets and the satellite payload. Compared

with other launch centers, this provides a payload advantage of 5%. In addition, rocket launches are possible from Kourou in a wide angular range from minus 10.5 to plus 93 degrees.

Launches are directed east over the Atlantic. This does not endanger populated areas with the descent of burned-out rocket stages or failed rockets. In addition, French Guiana is in an area not subject to earthquakes or tropical storms. Only the humid heat causes trouble for men and material. If left too long in the open, the salty air quickly attacks the sensitive rocket systems.

The French space authority CNS operates the Ariane launch center in Kourou for the European Space Agency. The ESA bears the major portion of the cost. When the launches using the new Ariane rockets start, roughly 1500 experts will be employed in this space center. Half of these will be Guianese. Various radio communications and visual orbit tracking stations along the Ariane flight path in Natal in Brazil, on the island Ascension in the Atlantic and in the African city of Libreville (Gabon) are also part of the "railroad station to space."

Preliminary planning assumes eight to 15 commercial payloads annually for the Ariane 5. Of these, four to six are to be carried into geostationary orbit using multiple launches. One to three launches are set for Earth observation and weather satellites. Some of these also will be in geostationary orbits while others will use low-earth orbits. In addition, about two Hermes missions annually are planned with the Ariane 5 to supply and maintain the space station Columbus.

The following timetable was prepared for the construction and operation of the launch facilities for the Ariane 5 rocket. So far, the work is on schedule.

1990: Start of production of solid-fuel segments for the boosters

1991: Integration of the first complete solid-fuel booster

1992: Beginning of acceptance tests for the entire facility

1993: First test of the Vulcan rocket engine

1994: All facilities and the rocket integration buildings finished

1995: Launch of the first Ariane 5 rocket, up to 10 launches to follow annually

Hermes Management, Design Developments Announced

Program Status

90WS0081A Paris AFP SCIENCES in French 5 Jul 90 pp 9-11

[Text] Paris—The 4 July message from the management of the European Space Agency (ESA) was clear: Europe is "going all out" on the space plane Hermes. Organizational and management preparations for this 4.5 billion-ecu program, which will give Europe mastery of man-in-space and access to the Western space station Freedom, and even to the USSR's station Mir, are progressing nicely.

"Hermes is off to a good start and we are ready to advise our governments to go ahead next year. We are doing everything we can to prove the plane can be manufactured, with our technologies and, most important, by Europe," said Mr Jorg Feustel-Buchl, director of space transport systems in the ESA, during a press conference held at the agency's headquarters in Paris.

In his opinion, Europe's political will to build Hermes was further buttressed by the decision last week of the West German Space Committee, presided by Chancellor Kohl, to approve support for all ESA programs for the year 2000, including Hermes. "That was a very important step, which shows that for the Germans, Hermes is now an essential element," he added to the AFP (French Press Agency).

Flanked by Mr Roger Vignelles, assistant general director and his counterpart at the National Space Studies Center (CNES), Mr Feustel-Buchl announced the formation of a joint ESA/CNES team of 150 to 180 people. It will be set up in Toulouse and led by Mr Michel Courtois, director of the CNES's Hermes program, with Mr Jean-Jacques Capart, his counterpart at the ESA, as assistant. The team, which will be responsible for full management of the program and for signing, for the ESA, manufacturing contracts, will be accountable to ESA and CNES management and to the agency's board.

"Toulouse will be the program's decision-making and industrial center of gravity, and that is only natural," says Mr Feustel-Buchl. "Aerospatiale, Dassault, and the joint team are already there. That is where the Hermes assembly line is to be installed. Nonetheless, other components, such as Hermes service module, will be made elsewhere, notably in the FRG."

The ESA has asked manufacturers of the 11 countries participating in the program to work together and come up, between now and the end of October, with a responsible industrial organization which will allot tasks and which will include Aerospatiale, Dassault-Aviation, DASA (Deutsche Aerospace), and Aeritalia. The three main Hermes contributors, France (43.5 percent), the FRG (27 percent), and Italy (12.1 percent), will thus be represented at the highest echelons of the program's industrial management, and the sacrosanct "rule of fair return" will be respected.

"Our aim is to be efficient and clear, to make the best use of experience and expertise to insure the continued life of the program. 530 million ecus have been allocated to its first phase, which is underway. 3.8 billion ecus will be

alloted for the second, which will begin next year, after final approval of the design by the agency's board," stressed Mr Vignelles.

The Hermes timetable has not been unduly delayed: six months only. Proposed by France in 1985 in Rome, Hermes became an ESA program two years later in La Haye during the European space conference. The plane's overall design is expected to be ready at the end of the year, and plans decided at the end of 1992 for critical scrutiny in 1994. The first subsonic flight is expected in 1996, and the first automated space flight in 1998, one year before the first manned flight carrying three astronauts.

"It will take three to four flights—at the rate of two a year—before the first operational flight to the Columbus unmanned laboratory module," says Mr Michel Courtois. "We still have a great deal of technical and aerodynamic work to do. Our biggest problem is weight. Now that the ejectible cabin has been ruled out and ejectible seats opted for, we have a margin of 15 percent (2.3 metric tons). But we will undoubtedly have to trim a few more kilos here and there."

Design Decisions

90WS0081B Paris AFP SCIENCES in French 12 Jul 90 pp 9-15

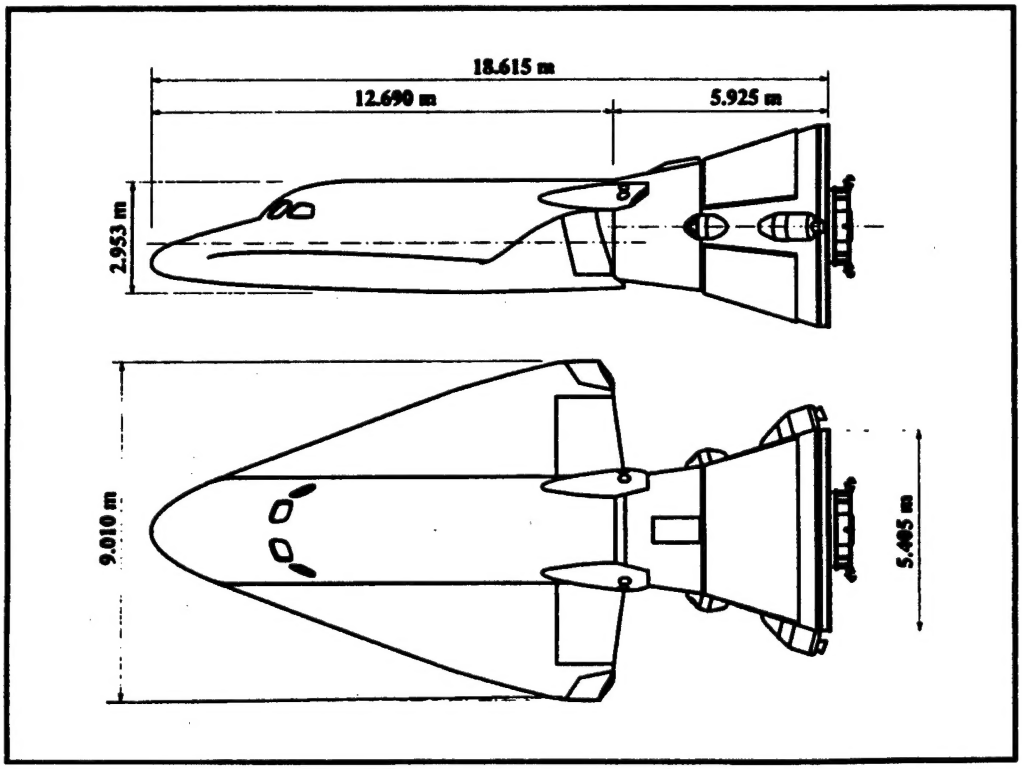
[Text] Paris—After a wait of several months, the European Space Agency (ESA) and the National Space Studies Center (CNES) announced the formation of a joint team1 last week. The latter will make the initial technical choices for the Hermes space plane and manage the entire program.

Composite-material structures, for instance, have been ruled out. And the delta wing with winglets will be stretched to the nose of the plane to better distribute heat and facilitate piloting during re-entry to earth.

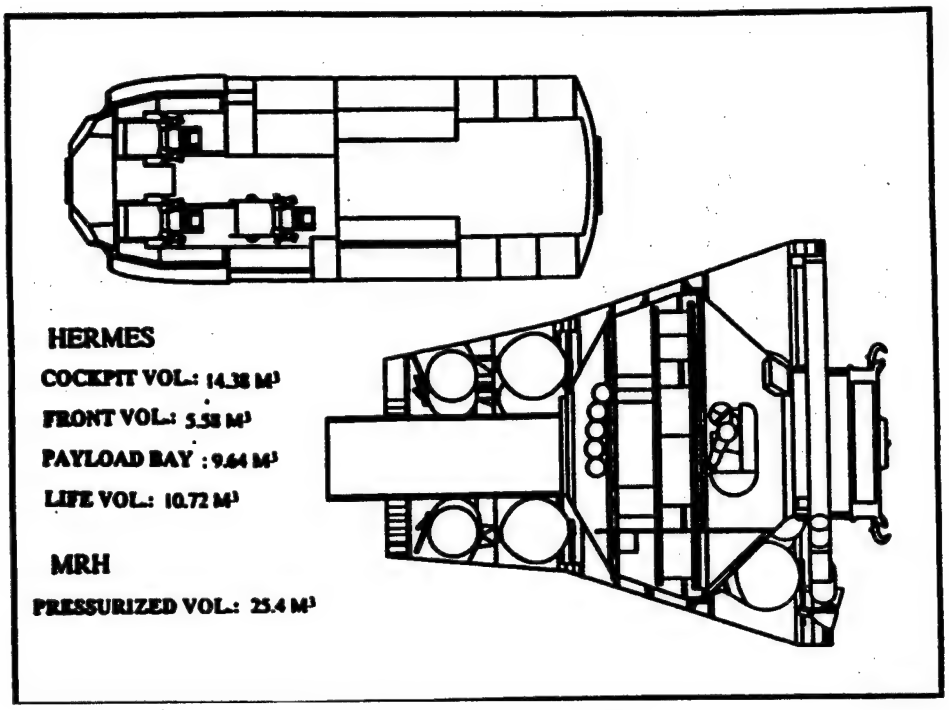
The service module will definitely be placed in the rear, will be jettisonable, and specifically designed for each mission. It will henceforth include the radiators for dissipating systems' heat and the remote handling arm for docking at the polar station or at the Columbus unmanned visitable laboratory. The docking chamber will stretch from one end of the module to the other.

According to current ESA-CNES plans, Hermes will be launched unmanned by an Ariane-5 for the first time in 1998, or 8 years after completion of its design, and following a series of subsonic flights in 1996 intended to test its aerodynamic capabilities. It will transport three astronauts for the first time in 1999.

The plane, which will be put directly into orbit, will have only attitude-control propulsion units for engines. It will weigh 22 metric tons at an altitude of 90 km when it is placed into orbit and will be traveling at at speed of 8 km a second at that time.



New Hermes Design (ESA documents)



Pressurized Sections of Hermes

A typical Hermes mission is expected to last 12 days, seven of which will be spent docked at the Columbus unmanned laboratory. Hermes will reach the lab, which for now is considered the reference-mission objective, after 48 hours in flight.

The laboratory will be turning at an altitude of 463 km at a 28.5 degree angle from the equator. The different rendezvous maneuvers aimed at reaching that orbit will require consumption of nearly one metric ton of fuel by the attitude-control-system engines placed in the nose and on two lateral "pods" at the rear of the plane.

Once Hermes is in orbit and securely docked by its rear section, the crew will have seven days to restock the laboratory, remove manufactured products, carry out maintenance, and eventually, if necessary, make excursions outside the station, etc.

Once the mission is complete and the plane has separated from the laboratory, Hermes will fire its engines to escape orbit and plunge toward Earth after jettisoning the service module (MRH). That operation will require another 800 kg of fuel.

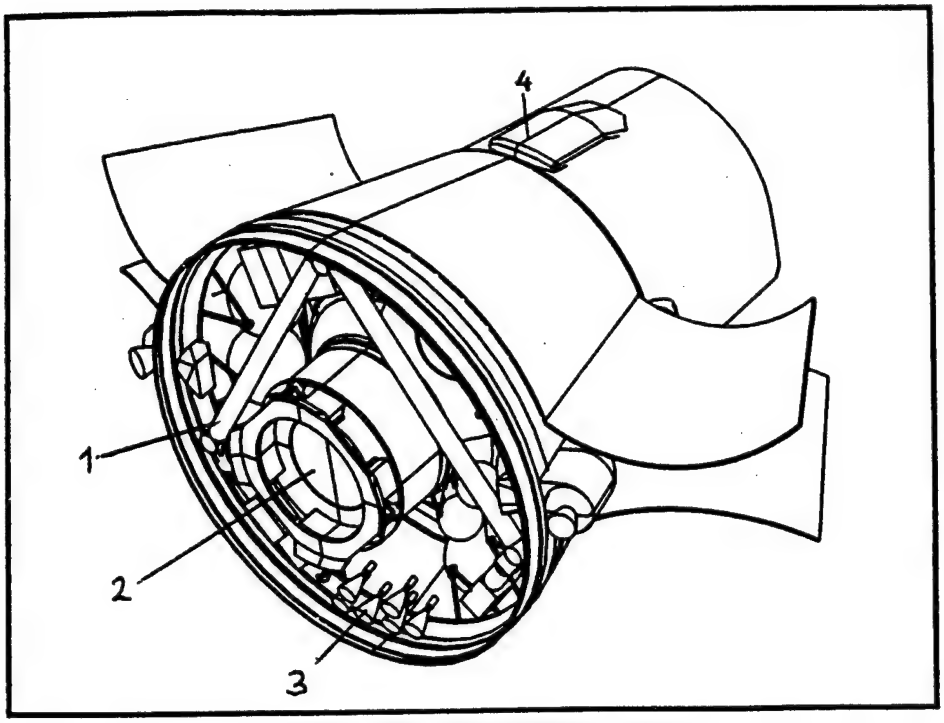
Re-entry into the dense layers of the atmosphere will begin at an altitude of 120 km, as it does for all American and Soviet space vehicles. This part of the return flight to Earth, effected without engine power, will slow Hermes from a speed of Mach 25 to an approach speed and will bring it to touch down at 346 km/hr on a 3-km landing strip. When it lands, Hermes, having jettisoned its service module, will only weigh 15 metric tons.

Altogether the plane and its service module measure 18.615 meters in length. Hermes is 12.690 meters long. Its wings have a span of nine meters. The diameter of the rear part of the service module is 5.4 meters, and it is also equipped with attitude-control engines which enable it to be piloted during separation from the plane. It has two small-rocket systems used during separation from the Ariane-5.

Placing the service module outside the plane results in more on-board volume for the crew. The front part of the fuselage is 5.58 cubic meters, the cockpit 14.38 cubic meters, the living quarters 10.72 cubic meters, and the service module itself 25.4 cubic meters. The latter contains a whole series of equipment and tanks necessary for different missions and, in the case of flights to the unmanned laboratory, space suits for outside excursions.

The adoption a few months ago of ejectible seats for the three crew members saved some three tons in the plane's mass. But although an increase in Ariane-5's carrying capacity is forseeable in the long run, more weight will have to be dropped. The ejectible seats, using the Soviet Mach-3 seat design, make it possible to remove the three men:

— on the launchpad should there be a problem before launching;
— up to an alititude of 25 km and a speed of Mach 3;
— starting at an altitude of 30 km during return to Earth, beginning at Mach 3 and;
— during landing should the need arise.

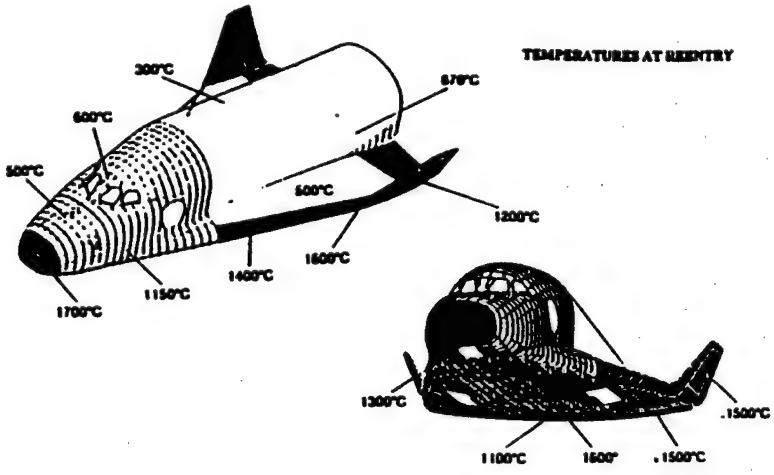


Service Module with Radiators Deployed

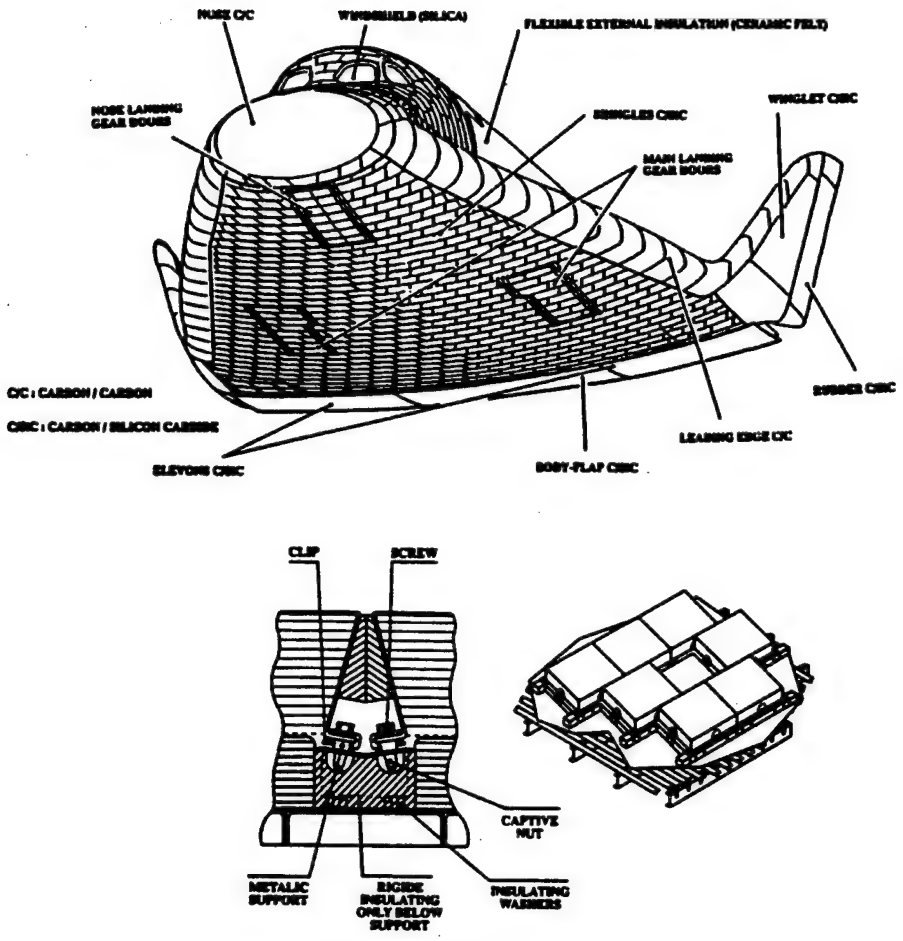
Key: 1. Remote handling arm—2. Docking ring—3. Attitude-control system—4. High-gain antenna

The recent technical decisions also concern the plane's heat-shield system. Previous studies had already demonstrated that the plane was subjected during re-entry to temperatures ranging from 300 degrees C on top to 1,700 degrees C on its nose. The studies have since been refined and have resulted in the adoption, for the "hottest" parts, of carbon/carbon pieces (nosecone, wing edges) and carbon/silicon-carbide tiles for the winglets and fins, elevons, the plane underside, and the front section of the fuselage. The rear section is to be covered with something like ceramic coatings, capable of resisting temperatures of up to almost 700 degrees. The cockpit windshields will be made of silicon, as the heat radiated that far reaches approximately 600 degrees despite the re-entry angle.

For everything associated with the underside and the hot parts of the fuselage, the specialists have turned to a system of bolted tiles, different from the system used on the American shuttles.



Hermes Heat Shield



New design of heat-protective tiles

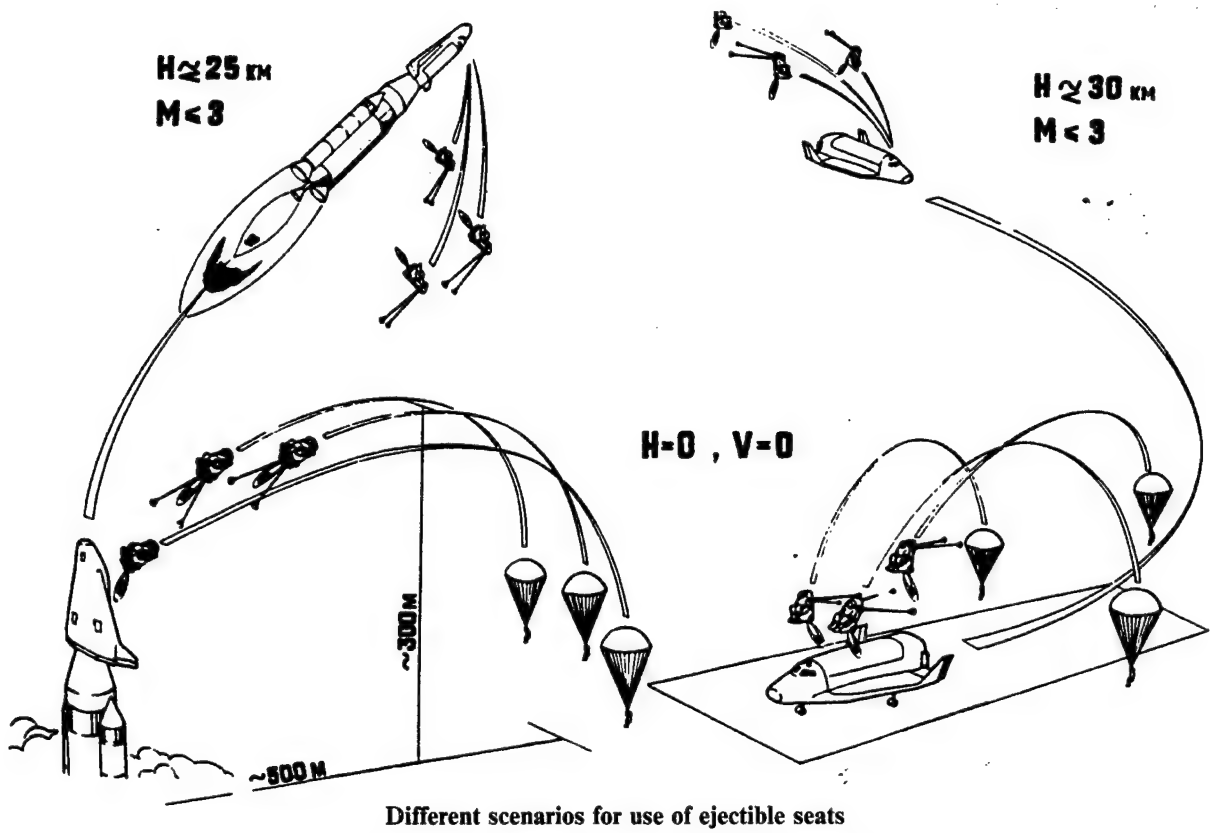
They have seen to it that the Hermes system can be flexibly adapted to different flight objectives by changing the equipment in the service module.

The basic design will remain the same for all missions to the unmanned laboratory, the Freedom station, or the Soviet station Mir. The docking system, for example, is identical for the mission to the European unmanned laboratory and to Freedom. In the latter case, however, the remote handling arm is removed, as it is for missions to Mir. For the Soviet station, the rendezvous and docking system changes, as does the position of certain tanks.

"For now we are limiting ourselves to planning missions to the Columbus laboratory and to Freedom, even though in the latter case, nothing is official yet. But the mission to Freedom is mentioned in the accord memorandum signed with NASA. It is a flight that could last up to 30 days. As far as the mission to Mir is concerned, discussions are underway," said Mr Michel Courtois, in charge of the Toulouse ESA-CNES joint team.

The weight of the plane still needs to be cut further, the problem of the center of gravity refined, and aerodynamic studies completed. "There is no hurry. We have until mid-1992. Studies of hot interfaces still need to be performed. We are studying the fuel cells needed by the plane, which must provide power of 500 watts to 4.5 volts, and we should have a model by the end of the year. But," admits Mr Courtois, "it's a tough problem. We wouldn't want to depend on the Americans, but if we have to for the first flights, we will buy the cells from them."

While Hermes is being readied, the ESA is continuing work to install the control centers and facilities needed to train crews, and the Hermes production line. "There will only be one assembly line—that's sufficient for two planes—and it is better to concentrate all Hermes activities in one spot, to avoid duplication of equipment and reduce costs," pointed out program officials. "As for the service module, it can have a life of its own and be totally assembled in the FRG."



Different scenarios for use of ejectible seats

Hermes will only make two flights a year to the Columbus unmanned lab module, as orginally planned. The plane will arrive in Kourou fully assembled, and will be rechecked there, its service module installed, and the payload placed aboard. The launch campaign as currently planned should last 10 days, and a flight, for a reference mission to the unmanned laboratory, 12 days. Though rendezvous-to-docking operations will last two days, return will take one. Once Hermes is back on Earth, it is planned to spend 10 days unloading and rechecking the plane, debriefing the crew, and so on.

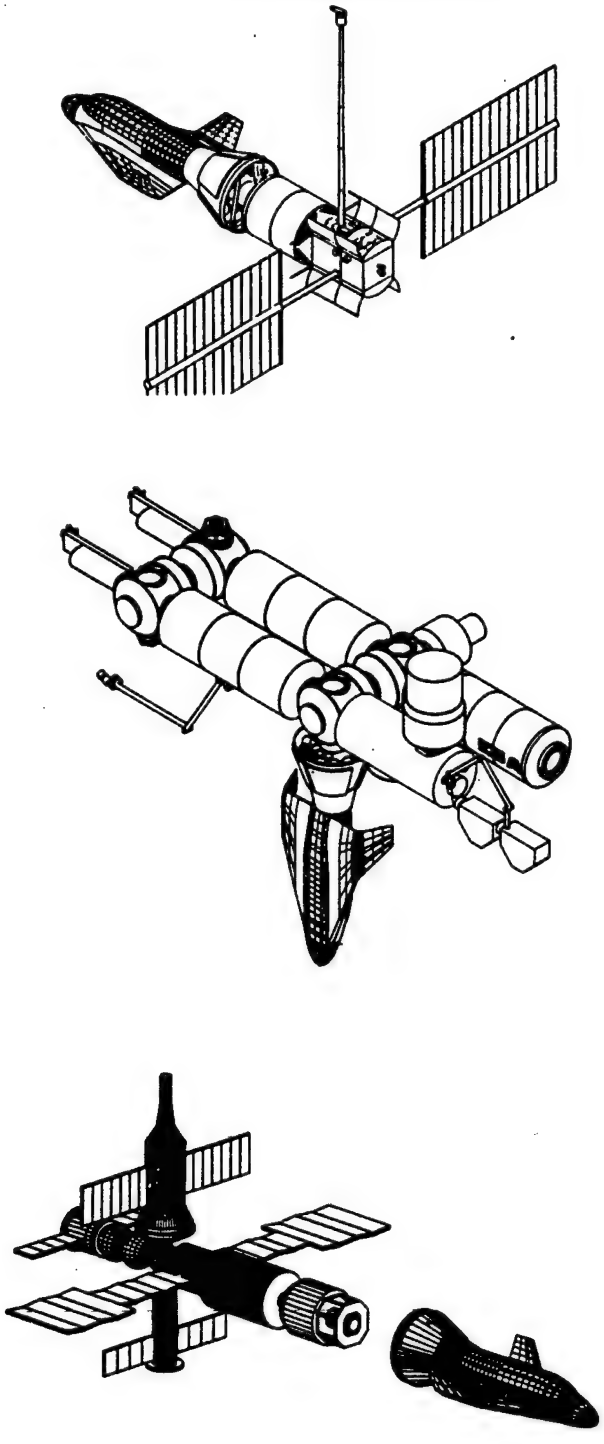
Hermes will need two landing strips: one in Guyana—at Kourou or Cayenne-Rochambeau, heated discussions are underway—to allow quick return to Earth in case of problems during ascent; and another in southern Europe, probably in Spain, for safe return of the crew to Earth should an incident occur during the final leg of ascent.

The costs of the Hermes program are being borne by different countries as follows: France, 43.5 percent; Germany, 27 percent; Italy, 12.1 percent; Belgium, 5.8 percent; Spain, 4.5 percent; the Netherlands, 2.2 percent; Switzerland, 2 percent; Sweden, 1.3 percent; Austria, 0.5 percent; Denmark, 0.45 percent; Norway, 0.2 percent; and Canada, 0.45 percent.

Footnotes

1. See AFP SCIENCES, No 724 of 5 July, 1990, p 10.

Hermes missions to the unmanned laboratory Columbus (top), the international station Freedom (middle), and the Soviet station Mir (bottom)



France: New Developments in Space Activities Reported

Space Robot Consortium

90MI0373A Rome AIR PRESS in Italian 19 Sep 90 p 2156

[Text] A consortium of French research agencies has launched a study on the development of robots for planetary exploration. The group is called RISP [Planetary Exploration Robot] and includes ONERA (National Office for Aerospace Studies), CNES (National Center for Space Studies), and CEA (Atomic Energy Commission). The goal of the consortium is also to prepare for a collaboration in this sector with the United States, Soviet Union, and the European Space Agency.

The primary goal of the project, known as VAP (Automatic Planetary Vehicle), is to develop a complex system of integrated robots by the end of 1992. Other goals include paving the way for a high-level French participation in planetary exploration missions and providing the French industrial sector with the know-how required to develop space robots. As far as the allocation of tasks among the consortium's agencies is concerned, ONERA will be in charge of designing the movements of the autonomous platforms for the manipulating arms as well as a diagnostics system to monitor the entire vehicle.

Matra Satellites, Soviet Carriers

90MI0373B Rome AIR PRESS in Italian 19 Sep 90 p 2158

[Text] The French group Matra has decided that the satellites constructed by its subsidiary Matra Marconi Space will become compatible with the Soviet Zenith carrier rockets to be launched from the projected private Australian base in Cape York. This is the first time that a western aerospace group has considered the possibility of having its own satellites launched by Soviet carriers. Furthermore, the French group will also take part in managing the future Australian "spaceport" in Cape York through Auspace, a company in which it has recently reacquired the controlling interest it had sold three years ago.

According to the president of Matra Marconi Space, Claude Goumy, the Australian spaceport will become operational in 1995-96. This future private launch site will be managed by an Australian company Cape York Space Agency (CYSA). It will be constructed by private Japanese companies and Lloyds with the support of the American company, United Technologies, which has recently been granted White House permission to become involved in the project. The CYSA has been authorized to acquire the Soviet Zenith rockets for launching from Cape York.

Germany's DLR Develops Microgravity Test Equipment

90MI0385 Bonn BMFT JOURNAL in German Aug 90 p 7

[Excerpt] [Passage omitted]

Scientists at the German Aerospace Research Institute (DLR) have proposed what they term a low-speed centrifugal microscope (NIZEMI) to measure the effects of gravity on biotic and abiotic systems. At the same time, the proposal has been adopted for the German space program; with the participation of the University of Bonn and a BMFT [Federal Ministry of Research and Technology] subsidy, industry has developed a laboratory model and delivered it to the DLR's Institute of Flight Medicine for initial testing. An instrument of this type is scheduled for use aboard the Spacelab during its IML-2 mission in about three years' time. NIZEMI can be used in space to study both biological systems (animal and vegetable cell cultures) and abiotic systems (for example, to observe crystal formation). Since differences in the behavior of these biotic and abiotic systems between 1 G conditions (terrestrial gravity) and 0 G conditions (microgravity) are generally very small and, therefore, difficult to demonstrate, the two states must be compared directly on a sample. NIZEMI makes this possible. In the ground laboratory NIZEMI supplements the standard experiments with rapid-spin clinostats (rotary equipment for eliminating the effects of gravity for microscopic examination) and can be used as a horizontal microscope in the upright position. This creates the basis for interesting observations of the biology of gravitation in the microscope, as sedimentation and flow processes due to gravity escape observation in the vertical microscopes that have been in standard use to date. In the NIZEMI, however, the optical axis always lies perpendicular to the directions of flow.

Germany: Construction of Hypersonic Wind Tunnel Started

90MI0386 Bonn BMFT JOURNAL in German Aug 90 p 7

[Text] Construction of the European Transsonic Wind Tunnel (ETW) has now begun in Cologne, in the immediate neighborhood of the German Aerospace Research Institute (DLR). The ETW will bridge the gap between the simulation capacities of the existing wind tunnels in Europe and actual flight conditions. Economic and ecological improvements can be achieved by reducing fuel consumption and aircraft noise; engines can also be further developed, in particular by reducing resistance, or, in other words, by improving aerodynamic flow circulation. The only facility comparable with the ETW to date is at NASA in Langley (United States). The ETW will offer the European aviation industry and aerospace research a unique test capability for optimizing the aerodynamics of aircraft such as the Airbus family, Hermes, and Saenger. To keep construction and operating costs as low as possible, the ETW uses nitrogen instead of air as the flow medium at temperatures down to -180°C and a variable pressure of up to 4.5 bar. This has made it possible to scale the working section down

considerably, and it measures only 2.4m x 2.0m. Construction costs amount to about DM660 million. By mid-1994, the BMFT's contribution will amount to approximately DM195 million.

Italy: New Developments in Space Activities Reported

Space Plasma Simulator

90MI0374A Rome AIR PRESS in Italian 19 Sep 90 p 2156

[Text] The SIMPLEX space plasma simulator was inaugurated by Learco Saporito, under secretary of research, at the CNR's [National Research Council] Institute of Interplanetary Space Physics (IFSI) in Frascati. The simulator, which is the only one of its kind in Europe, will reproduce the space conditions encountered by the TSS (Tethered Satellite System) during its first mission with the Shuttle. During the flight, the TSS will be released into the ionosphere by the Shuttle and will later be retrieved using a 20 km tether. Funding for the SIMPLEX's development began in 1985 under the CNR/National Space Plan, which later became ASI (Italian Space Agency). Also presented at the inauguration was the EGA (Electron Gun Assembly), namely the electron gun necessary to monitor the TSS's potential, developed by Proel as Aeritalia's subcontractor.

Robotics Contract For Columbus Space Station

90MI0374B Rome AIR PRESS in Italian 19 Sep 90 p 2156

[Text] The European Space Agency (ESA) has recently assigned Tecnospazio (a Fiar, Comau consortium) with the development of the ground-based automation and robotics demonstrator for the Columbus space station. The contract covers the development and supply of a special manipulator, off-line programming system and simulation equipment for the control system, and four trial tests. The contract also involves integrating the ground-based demonstrator with the telescience demonstrator and with the astronauts' workstation at the ESTEC [European Space Research and Technology Center] laboratories in Noordwijk (the Netherlands). For the first time, this demonstrator— to be developed by Tecnospazio as the prime contractor of an industrial team which includes Aeritalia, Dornier, Matra MBB [Messerchmitt Boelkow Blohm]/ Erno, etc.—will check the complete testing architecture, from scientists to astronauts and the robotized activities aboard Columbus.

European Space Agency Contracts

90MI0374C Rome AIR PRESS in Italian 19 Sep 90 p 2156

[Text] CISET [Italian Technical Services Company] in Rome has recently been awarded two contracts by the European Space Agency (ESA). The first contract involves developing a considerable part of the operational software for the ESOC center in Darmstadt, while the second involves providing engineering services for the operations of the ESA's future manned and unmanned space programs. The duration of both contracts—from this year until 1995—is sufficient to cover the crucial design and development stages of the Earth section of current European programs.

Italy: Aeritalia Leads Environmental Monitoring Aircraft

90MI0365 Rome AIR PRESS in Italian 12 Sep 90 p 2056

[Text] Aeritalia still leads the Advanced Amphibious Aircraft (AAA) program with a 56 percent share. Other participants include Dornier (FRG), HAI-Hellenic Aerospace Industry (Greece), Per-Udsen (Denmark), and Soko (Yugoslavia) while according to rumors at the Farnborough exhibition, Aerospatiale may also become involved. The AAA's industrialization and marketing cooperation agreement was signed by the five partners in London on 3 September. The first prototype will be ready to fly by mid-1995 while certification and deliveries are scheduled for late 1997.

Other partners are currently being sought and priority is being given to EEC companies to preserve the "European" nature of this project, which falls within the wider EUREKA [European Research Coordination Agency] research program. In 1988, EUREKA funds were allotted for a technological definition stage which ended last April. On 1 June, additional EUREKA funds were allocated for a second research stage also lasting two years. This stage is expected to cost about 12.7 million ECUs and will include research on aerodynamics and hydrodynamics, new structures and materials, anticorrosion techniques, innovative hull design to ensure takeoff and landing even in very rough sea conditions, and avionics and advanced equipment to improve the safety and performance of the mission.

The aircraft will perform various functions that are currently carried out by aircraft whose design is outdated. These functions include patrolling, ecological sea surveillance, environmental monitoring, search and rescue operations, and fire fighting, which is the activity that draws the greatest attention.

The AAA project was presented by the director of Aeritalia's Transport Aircraft Group, Engineer Nino D'Angelo. The need for this type of aircraft is estimated to be 200 by the year 2000, but its versatility and the growing importance of "environmental" missions are likely to lead to a considerable expansion in a market which appears to be dominated by Europe (36 percent) and the Middle East (33 percent). The greatest demand is expected to be in fire fighting (44 percent) and search and rescue operations (23 percent).

Italian Space Agency's Programs, Funding Presented

90MI0366 Rome AIR PRESS in Italian 12 Sep 90 p 2076

[Text] The ASI [Italian Space Agency] launched programs worth 630 billion lire during the first six months of 1990. The announcement was made by the president of the ASI, Luciano Guerriero, at the Farnborough exhibition. Part of this amount involves projects lasting several years.

In particular, a 160-billion lire contract with Selenia Spazio for the second Italsat satellite was approved as was a 170-billion contract with Aeritalia for the first development stage of the X-ray astronomy satellite (SAX). At the European level, both the DRS (Data Relay Satellite) space telecommunications program assigned to Selenia Spazio, and the second Earth Resources Satellite (ERS-2) were approved. At the national level, BPD Difesa e Spazio's program to improve the potential of the Scout carrier (3.2 billion lire) was approved, while Aeritalia launched a program for a feasibility study on the CARINA [Unmanned Reentry Capsule] orbiting reentry capsule (7 billion lire). The goal of both programs is to develop a complete and independent launching capability for small satellites at the national level.

For the same reason, that is the development of Italian carriers, an agreement was also reached with the University of Rome to improve the launching potential of the San Marco launch site. CIPE [Interministerial Committee for Economic Planning] advanced 90 billion lire of ASI's funding under the next five-year plan for this project. The ASI's 630-billion lire commitments for this year also include a contract with Arianespace for the SAX satellite launch (102 billion lire over five years) and for part of the Earth-based receiving stations (15 billion lire), a contract with Telespazio for the collection of data from the ERS-1 (51 billion over five years), an insurance coverage for the Italsat satellite launch (16 billion lire), and the renewal of a contract with Telespazio for the management of the space station in Matera (12.7 billion lire over two years). Finally, Fiat was assigned 1.5 billion lire for the development of the Ariane 5's turbopump, and Aeritalia 1.3 billion lire for a preliminary study on the SPIDER [Space Inspection Device for Extravehicular Repairs] space robot.

Italy: Telecommunications Satellite Project Presented

90MI0367 Rome AIR PRESS in Italian 12 Sep 90 p 2079

[Text] Sicral, a telecommunications satellite system for military and civil defense applications, was presented at the Farnborough exhibition as one of Selenia Spazio's current projects. Selenia Spazio is the prime contractor for the entire space-earth system. The program is currently at the detailed project stage while the development stage is scheduled for 1991 and launching is expected to take place in 1994-95. The Sicral system will perform the following functions: support and complement tactical and strategic telecommunications networks by using fixed, mobile, and transportable terminals with a domestic, European, and worldwide coverage and a wideband telecommunications capability (such as high definition images); fast document transmission and broadcasting; support the communications, command, control, and information operations carried out by the military, naval, and air forces; national emergency communications services for the Ministry of Internal Affairs and Civil Defense; provide support in the fight against terrorism, large-scale crime, and drugs by coordinating the relative data collection and transmission centers. The communications resources will be managed by either the armed forces' network of control centers or by those of a single branch, depending on the operational requirements, and will be coordinated by the Joint Chiefs of Staff. The satellite to be used for the Sicral system derives from Italsat; its platform will be stabilized on three axes and it will weigh approximately 2,000 kg. The Earth-based terminals and satellite transponders will make partial use of the technologies developed under the Italsat telecommunications program.

The Sicral system has the following characteristics; interoperability with systems used by NATO and the European allies, a high resistance to intentional interference (jamming), a high level of adaptability to different operational conditions, adjustable geographic coverage, high traffic capacity, communications security and secrecy, and a high overall reliability.

Italy: Measuring Device for Microgravity Experiments Developed

90MI0362 Milan CISE NEWSLETTER in Italian Jul 90 p 3

[Text] Measuring the interfacial tension between two immiscible liquids is difficult owing to the complications created by the earth's gravitational field.

The CNR's [National Research Council] ICFAM institute for the study of materials has developed an experiment in collaboration with CISE (Center for Data, Studies, and Experimentation) to obtain measurements under microgravity conditions. Swedish MASER's were used for this purpose. These rockets are designed to test materials and are capable of carrying out parabolic flights lasting approximately 10 minutes at a height of approximately 300 km where gravity is negligible. The advantage of these rockets compared to the American space shuttle is that experiments can be scheduled in the short term, within 12 months, as opposed to the long period of a few years required for the space shuttle. The experiment, which was successfully carried out on MASER 4, involved measuring the interfacial tension between distilled water and bromonaphthalene, a chemical compound used in optics. The liquids are put into contact by using a syringe system to form a drop that does not mix. On the earth, this drop would immediately be deformed due to the effect of gravity, while in space it remains perfectly spherical since it is not affected by weight.

At CISE, Engineer Alfredo Squilloni was in charge of the project and the construction of a device capable of measuring the interfacial tension, which is the physical characteristic of the pair of liquids being examined, in microgravity. CISE developed the mechanical part of the equipment used for this purpose.

Given the spherical shape of the drop it is possible to obtain the interfacial tension with a mathematical formula which compares the ray of the drop itself to the differential pressure between the two liquids. The relationship is extremely simple. If this measurement were to be carried out on earth, the formula would be far more complicated since the variable curve of the ray from one point to another would have to be taken into account.

The Italian experiment occupied a module of the MASER 4 payload. The syringe's plunger, which injected the bromonapthalene into the distilled water, was activated by using a stepping motor controlled by an electronic microprocessor that was designed and developed by Officine Galileo. A special, highly sensitive and capacitive pressure transducer gave the electrical signals that were associated with the variation in differential pressure. These were then recorded on special memories that were part of the experimental equipment.

This experiment can also be repeated with varying injection times and volumes.

When the rocket reached a height of 50 k, an impulse from the centralized system activated the experiment and all its programmed sequences. The interfacial tension was obtained by measuring the displaced volume to calculate the ray of the drop. A video camera was mounted aboard the module; while this was not strictly necessary it proved very useful in observing the execution of the experiment in real time. After approximately 10 minutes at the end of the parabolic flight, the part of the rocket containing the module fell approximately 50 km from the launch site with the help of a parachute. A radio signal emitted from the ogive made it possible to recover the payload with a helicopter.

AUTOMOTIVE INDUSTRY

French Electric Car Interministerial Group Established

91P60017A Paris LE MONDE in French 9 Oct 90 p 27

[Article: "The Government Wants To Promote the Electric Car"]

[Text] Jean-Louis Richard, formerly with the French Agency for Energy Conservation, will head the Electric Car Interministerial Group (GIVE), established by the government to promote French research in this area. GIVE will be responsible for all financial and regulatory measures promoting the development and use of the electric car. The clean car project, which was presented this year by the ministries of industry and of research, has been allocated 125 million francs. Moreover, according to proposed financial legislation, electric car purchases will be 100 percent depreciable in the first year beginning in 1991.

BMW's Electric Auto Project Described

90WS0094A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 3 Sep 90 p 10

[Article by Karl Tetzner: "Electric Autos Not Economically Feasible Before 1995: Real Operating Costs Unknown / Weighing Environmental Concerns"]

[Text]Frankfurt, Sep 2—When it comes to the electric automobile, a big gap yawns between wishful thinking and reality. Those who remember the old Post Office delivery vehicles of the 1920s, those clumsy, slow, rubber-tired lemons, may be disappointed that 65 years later there still is not an economically feasible short-distance automobile that environmentalists all have been dreaming about. At the heart of this dream is a battery with high capacity, relatively low weight and a long life span.

In the long run, lead accumulators will not satisfy these requirements. They are extremely heavy, voluminous and barely last for two years when in continued use. A new sodium/sulphur high-energy battery developed by the Asea Brown Boveri company, however, appears to offer some initial solutions to these problems. This battery consists of 360 individual cells and is divided into four segments with 90 cells each. It requires no maintenance, has hardly any gassing problems and, most importantly, it has three times the energy density of a lead accumulator.

Its no-load voltage ranges between 170 and 200 V and its life span is approximately 150,000 kilometers. An essential prerequisite for this battery's operation are dilute sodium, sulphur and sodium polysulphide, to avoid substantial increases in the internal resistance of the battery. Another essential feature is maintaining an optimum operating temperature of approximately 320 Centigrade which is automatically achieved through heat generated by combustion when the automobile is in operation.

But what when the automobile is not in operation? Even with reliable thermal insulation, 200 Watts of constant heat are required to maintain the battery in start-up condition. A further problem is posed by the electric engine itself and its dependence on the battery's capacity. A D.C. engine developed by Asea Brown Boveri is currently considered the best available because it requires only simple control mechanism. But it does not appear to be second to none. The Munich automobile manufacturer BMW, with its own department dedicated to developing electric vehicles and running eight test autos, attaches great importance to the development of A.C. engines, even though they require rather elaborate control mechanisms. However, they have low manufacturing costs.

BMW is not enthusiastic about the two-person electric automobile. Instead, the company is concentrating its efforts on the small 3-series BMW featuring appropriate adaptations, including front-wheel drive. What will be missing in the new models are spark ignition engines with manual five-gear transmission, cardan shafts, and rear-axle gears. The battery fits underneath the trunk and there is room for two children's car seats in the rear. The remaining load capacity is reduced to 350 kilograms.

Furthermore, new problems arise as a result of the electric engine itself. The 12 V lighting equipment will continue to require a separate battery which, by circumventing the generator, is recharged directly from the main battery. A separate diesel device with a 7-liter tank should be provided for the hot-water heating system.

This prototype accelerates from zero to 50 kilometers in nine seconds. Its top speed is 100 kilometers and it has a range of up to 150 kilometers per battery recharge. As the automaker's scientific manager of the development department reports, BMW's goal is to extend the range to

200 kilometers in city traffic, to increase the maximum speed to 120 kilometers and to improve acceleration to seven seconds (from zero to 50 kilometers). It is expected that these objectives will be achieved as early as 1992. Long-term test runs, for example with delivery services by the German Federal Post Office in Nuremberg and surroundings, have shown promising prospects.

However, the manufacturer now must confront the rather important question of the price of the automobile and its true operating costs, subjects that have been ignored so far. Presently, a sodium/sulphur battery as described above costs approximately 14,000 German marks each. And so far, there has been hardly any mention at all of the price of the electric engine. It is true that prices will come down once the engines go into mass production. This, however, is contingent on brisk demand which, in turn, depends on the price. Probably the best way to break this vicious cycle is to offer the first electric car series to government and Post Office officials—in the hope that these customers will not be as price-conscious as the free market.

In all these deliberations, consideration must be given to the fact that in the Federal Republic of Germany, the charging current for the batteries would have to be generated primarily in coal power plants which, despite all efforts to clean up their emissions, are a heavy burden on the environment. It is important to determine whether the residual harm done to the environment by automobiles with catalytic converters is not proportionately smaller than the damage caused by electric vehicles by virtue of the fact that they run on energy generated by coal power plants. The BMW automobile company with an annual investment in the electric automobile development of several million German marks, and even more in autos with hydrogen propulsion, has stated this dilemma pithily: "To be sure, the electric concept is no alternative to the combustion engine."

German Advances in Auto Electronics Systems Noted

90WS0097A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 4 Sep 90 p 8

[Article: "Increased Use of Microelectronics in Automobile Production—Microelectronics Expected To Account For an Increasing Share of Manufacturing Costs—Trend Towards a Practically Noiseless Car"]

[Text] Scha. Frankfurt, 3 Sep. Microelectronic systems in automobile production have been enjoying extraordinary growth rates. However, drivers have been mostly unaware of this development; they barely noticed that numerous mechanical, electromechanical, and hydraulic motor control functions have been replaced by microprocessors, sensors, and other electronic components. However, over the next few years, the impact and consequences of electronic applications will become much more noticeable. Antilock braking systems (ABS) and wheel speed control, active suspension, system diagnostics, navigation systems, advanced indicators as well as auto satellite communication will constitute an increasing percentage of total production costs. According to the marketing research firm Dataquest, this share will increase from less than eight percent at present to at least 10 percent by 1995. On a worldwide average, microelectronic components currently account for $218 per vehicle. This figure is projected to increase to over $300 by 1995.

The reasons for this increased use of electronics in cars will remain the same: better driving performance and increased comfort for the driver, continuing improvements in auto emission control and auto safety for legislators, and improved manufacturing processes and reliability as well as higher profit margins for manufacturers. The semiconductor industry, however, is faced with a formidable list of requirements from the automobile manufacturers since the electronic components which are usually custom-built must be able to function both at antarctic and subtropical temperatures and must be able to withstand the effects of grease, water, soot, and vibration over many years.

The demand for even more electronics in the automobile of the nineties is reflected in the new technologies which will be used. Examples are the transition from 8-bit to 16-bit and 32-bit processors, networking and the synergy of subsystems, the use of power semiconductors, more advanced linear ICs and other new semiconductor components.

By the year 2000, these new and more advanced semiconductor elements will have doubled the number of areas where electronic systems can be used. Between 1988 and 1994, the sale of chips to the automobile industry is expected to double and reach $375 million. According to industry experts, the first generation of automobile electronics—the use of mechanical control functions, the era of the "8-bit microcontroller"—came to an end last year. Now, the second generation is being introduced, with high performance 16- and 32-bit microcontrollers and digital signal processors (DSPs). Their scale of integration, storage capacity and speed will increase tremendously, from 128 Byte RAM/2KB ROM to 16 KB RAM/512 KB ROM, from a clock frequency of 4 MHz to more than 50 MHz, from less than one MIPS (million instructions per second) to probably more than 30 MIPS by 1999.

DSPs are suited particularly well for use in automobiles. In connection with pressure sensors in the cylinder, for instance, they can provide closed-loop, real-time motor control. This would result in extremely precise antiknock solutions with optimum ignition control. Only DSPs have the computing power and speed to react to every wheel change fast enough and to absorb most of the irregularities. In a car, the combination of analog and digital technologies in one chip is just as important as component reliability and durability in a rather hostile environment. One other example of future applications is the electronic muffler which is able to "offset" motor noise in the passenger compartment by generating exactly the opposite radio frequencies. In connection with other electronic centers, this muffler would be able to provide a practically noiseless car.

Role of Sensors in German Industry Automation Described

90WS0086B Duesseldorf HANDELSBLATT in German 1 Aug 90 p 22

[Article by Volker Tisken: "Sensor Identifies up to Eight Different Colors: Efficient Identification Systems Support Automation of Material Handling Systems"; first paragraph is HANDELSBLATT introduction]

[Text] TL, 31 Jul—Automated materials handling technology in the production process requires reliable monitoring of the flow of materials. Simple sensors are already relieving processing computers of this task. However, complex handling systems only become flexible and manageable with object identification systems. This example illustrates that sensor technology is going beyond its conventional limits. It is beginning to communicate with objects.

Despite all the complaining about cars all looking alike, each German auto manufacturer produces only a small number of completely identical vehicles within a single day's production. In highly automated series production, a chaotic sequence of extremely varied customer orders is brought to bear. Materials flow and handling technology therefore take on key significance. It is only with their help that it is possible on the one hand to achieve the increases in productivity anticipated from automation and on the other hand to further improve the level of flexibility. The right material must be at the right place at the right time.

Therefore, conventional forms of organization of materials handling can only be used now in simple applications: The materials handling system is timed and a image of it is run in the memory of the computer, paralleling its actual progress. Thus, the computer can direct each transported item to the desired target location without having to identify it on site.

If the computer memory is disturbed or if its contents are completely lost, the computer would cause chaos without security devices and reconstructive help. In addition, such a system is very rigid since, for example, the sequence of items maintained on the materials handling path by the computer cannot be altered at will. "With only simple sensor technology, it is possible to provide valuable support to such a system," according to Dipl.-Eng. Gerhard Lang, manager of AEG's production automation department. "The designing of automated complex materials handling technology is however no longer possible without intelligent identification sensors."

Conventional Sensors Remain Relatively Dumb

A variety of sensors with different response relationships is available for automation solutions. Nevertheless, the conventional sensors primarily used are "dumb." It is true that they notice an object, but they do not identify it. They function like a knife-blade switch, i.e., they forward a signal when they are tripped. Only with subsequent logical signal processing can messages from sensors lead to automatic "intelligent" reactions. Now, sensors which can also differentiate between their messages are being used. Thus, for example, a color identification system developed by AEG differentiates between as many as eight different colors 200 times per second using an optical sensor. The colors to be identified can be accurately set using a reference adjustment and are reliably identified from a palette of 20,000 colors or gray levels. This system is used as a conventional sensor in many industrial processes and production cycles. It can also make its identification based on the color of the object itself or even a mark applied to it: Thus, hand in hand with control logic, materials cases can be distributed, wrong model transport containers can be sorted out, or cable strands of different colors can be produced and forwarded to the production system in the right order.

AEG classifies the system as part of the object identification system (OIS) although it is not really comparable to the other members of that product family. As a link it is an example of the evolution of conventional sensor technology into object identification. The more complex systems which operate with data carriers and microwave transponders (OIS-M) or with inductive data communication (OIS-I) enable much more detailed identification.

With Data Carriers Information Is Always Current

The data carrier applied to the product or to the transport palette can be read or written as it passes by stations. At each production station, necessary manufacturing and finishing processes can be requested without having to dig up related data via communication networks. Through job acknowledgment messages and timely data transmissions, the current status of production is can be observed all the way down to the individual task.

OIS-M uses microwaves as the energy supplier and as the data carrier. The write-read device and the data carrier make reliable contact even at a distance of 70 cm. Local intelligence as it is understood in microelectronics is therefore completely independently located in the data carrier: Inside a matchbook-sized hermetically sealed metal and ceramic housing is a small power plant, a microwave receiver and transmitter, and an EEPROM (electrically erasable programmable read-only memory) along with the associated miniaturized programming device. This system configuration is structured as a hybrid assembly of the currently robust form of complex electronic circuits.

Comparable systems are either many times larger or more sensitive to heat, dust, paint, and moisture. The high level of technology makes the system not exactly cheap in the numbers currently produced. A data carrier for the inductive sister system OIS-I cost much less. It is equipped with a static RAM chip and requires a low but continuous flow of current. Therefore, it also contains a small battery which lasts at least 8 years. The inductive data transmission only operates when the station and the

data carrier are a few centimeters apart. Data transmission is also slower. Thus, the areas of application for this more cost-effective technology are also more limited. Auto manufacturers have for the most part opted in favor of OIS-M. At Mercedes Benz and Ford in Cologne, it accompanies parts and car shells through welding systems, paint lines, drying ovens, and assembly stations.

Swiss Research on Toluol, Hydrogen Fuel Described

91WS0002B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 24 Sep 90 p 10

[Text] Zurich 23 Sep 90—The frequently touted hydrogen economy of the future encounters difficulties with the proposition of using hydrogen to fuel motor vehicles. According to current thinking, the fuel would be used in a liquefied and deep-frozen aggregate, as a high pressure fuel, or stored in metal hydrids. The best application for hydrogen is in its liquefied form at minus 252 Centigrades; however, the energy required for its production and the insulation needed for its storage is excessive. It is difficult to envision the distribution of such hydrogen fuel on motor vehicles without tremendous efforts. However, there is the possibility of binding hydrogen in its liquid aggregate and using the resulting "organic liquid hydrids" as fuel, a process initially developed in the United States during the 1970s. This would simplify the operation of a vehicle significantly as it would enable the user to fill up a tank with hydrids as he would with gasoline.

For the present, hydrogen-enriched toluol could serve as the fuel. This process involves adding three hydrogen atoms to the toluol, thus creating the compound methylcyclohexanol. No energy is required for this synthesis; on the contrary, energy is released as a result. However, heat supply is needed for the utilization of the hydrogen. In a dehydration device, the methylcyclohexanol is split at 400 Centigrades with the hydrogen entering the engine and the toluol remaining behind; the toluol is reusable for further syntheses.

This idea of utilizing hydrogen in motor vehicles by means of an "organic hydrid liquid fuel" was picked up a decade ago by the "Eidgenoessisches Institut fuer Reaktorforschung (EIR)" in Wuerenlingen, Switzerland. Further research is currently being conducted for purposes of developing a commercially viable vehicle. As was recently reported by the "Bulletin" of the "Eidgenoessische Technische Hochschule" in Zurich, the research is being performed by the "Paul-Scherrer-Institut," the successor organization to the EIR. In the "MTH"-Project (methylcyclohexanol-toluol hydrogen project), emphasis is placed, above all, on a dehydration device and on an internal combustion engine running on hydrogen fuel. The dehydration device is voluminous and heavy. Reducing its size to fit an ordinary car poses a central problem for a potential full-scale utilization of hydrogen fuel.

In the first test truck built, the "MTH-1", the dehydration device took up the truck's entire loading area. In 1985/87, "MTH-2" was built with the dehydration device taking up merely one third of the truck's loading area. This test vehicle ran as much as 45 kilometers on MTH fuel. Work on further scaling down the size of the dehydration device continues with the aim to arrive at an apparatus so small that one day, busses will run on MTH fuel. However, a reduction of the device to fit an automobile appears to be an unrealistic proposition for the time being. The first test bus running on MTH fuel is expected to be operational by the second half of the 1990s, according to Thomas Schucan of the "Paul-Scherrer-Institut."

The Institute's fuel project for motor vehicles is conducted within the framework of a large-scale international endeavor to perform further research and development on hydrogen power, the so-called "Euro-Quebec Hydro-Hydrogen Pilot Project" abbreviated "EQHHPP." Forty companies and organizations from seven countries are participating in this pilot project under the auspices of the EC and the Canadian province Quebec.

Those involved in the project envision generating hydrogen from hydroelectric power with a capacity of 100 megawatts. Part of the generated hydrogen is deep-frozen and transported to Europe in special tanks, part is synthesized to MTH and brought to Europe in conventional tanks. The MTH could then be processed partially in stationary dehydration equipment, with the hydrogen then delivered to large consumers, perhaps even to private households, but certainly to power plants. The other part is intended for use as liquid fuel in automobiles and power plants. In either case, the recovered toluol must be collected and returned to Canada for renewed synthesis.

Currently, the "EQHHPP"-Project is in the phase of technical definition, i.e., directly before assembly of the equipment. A handicap for the entire range of application of hydrogen in IC engines or turbines is the formation of nitrogen oxide as a result of the burning of hydrogen with air which, as is generally known, consists to 4/5th of hydrogen. The only way to avoid the formation of nitrogen oxides is using pure oxygen (which would require an unrealistic surplus of work). So far, the problem of neutralizing the effects of nitrogen oxides is yet to be resolved. However, it will place an undue burden on the application of hydrogen in automobiles because of the additional weight and space requirements.

BIOTECHNOLOGY

EC BRIDGE Program Analyzed

91AN0029 Rijswijk BIOTECHNOLOGIE IN NEDERLAND (English-language supplement BIOTECHOLOGY IN HOLLAND) in English Sep 90 pp 125, 128

[Article by Kees Planque: "The Netherlands Are Fairly Well Represented in BRIDGE"; Kees Planque is project manager biotechnology at the Dutch Department of Economic Affairs and responsible for the national technology program on biotechnology; passage in italics as published]

[Text] *Last April decisions were made on the distribution of 60 percent of the ECU 100 million of the BRIDGE program. BRIDGE stands for Biotechnology Research for Innovation, Development and Growth in Europe, the biotechnology programme of the European Community. Although the outcome of the decisions made is not a final list of projects and contractants but a list of projects nominated for funding, meaning contract negotiations, it is interesting to take a closer look at the results of the tender and the outcome thereof. With special attention to the Dutch participants.*

BRIDGE is made up by transnational cooperative research projects: Normal or N-projects, averaging 4-5 participants, and large Target or T-projects, containing over 20 participants. BRIDGE aims at the development of fundamental research on the basis of cooperation and training by means of research adapted to the long term needs of the Community. Besides research, a training program and concertation activities make up BRIDGE. It will run over the years 1990, 1991, 1992 and 1993.

The foreseen distribution of the ECU 100 million budget is as shown in table 1. Three quarters of the budget are intended for research and 10 percent will go to training in biotechnology. Over the last few years participation by junior scientists from the Netherlands in the training program has been relatively low. In case of interest in applying for a training grant, contact the EC liaison bureau.

Table 1. The budget of BRIDGE

	Million ECU
N- and T-projects	77
Training program	10
Concertation	9
Management cost	4

Concertation activities comprise a number of different tasks, distinct from research and training elements. Main objectives are:

- Raising the level of awareness of national R&D programmes
- Creation of a European network of biotechnology policy related interests in national administrations
- Collaboration on Community co-financed activities, such as public information and discussion oriented workshops
- Information exchange on EC services activities related to biotechnology.

The concertation activities are managed by CUBE, the Concertation Unit Biotechnology, run by Mark Cantley.

The decisions made last April were related to a tender which was open in the autumn of 1989. At the moment a tender is open for proposals on biosafety, which will close September 1990. Later this year a tender for a T-project on animal cells will be opened.

Results of the BRIDGE Tender

A total of 402 projects were submitted: 346 N-projects requesting a total of ECU 325 milion and 56 T-projects adding up to ECU 41.7 million. The budget available at this stage was ECU 60 million. Projects were ranked by outside experts for each research topic on scientific quality and subsequently on BRIDGE characteristics: transnationality, industrial participation, etc..

N-Projects

Several questions rise when nearly two thousand academic and industrial applicants from 12 EC and a number of non-EC countries apply for roughly 350 projects, among others:

- How is the distribution over the different fields
- What are the national strengths
- Which projects are nominated for funding and how is the national participation?

Table 2. Submitted N(ormal)-Projects*

	Belgium	France	Netherlands	UK	Denmark	FRG	Portugal	Greece	Spain	Italy	Ireland	Others
a	8	8	6	19	10	25	-	5	6	12	1	-
b1	6	15	11	18	2	20	3	4	8	10	1	1
b2	6	15	13	14	1	19	6	6	9	9	2	-

Table 2. Submitted N(ormal)-Projects* (Continued)

	Belgium	France	Netherlands	UK	Denmark	FRG	Portugal	Greece	Spain	Italy	Ireland	Others
c1a	8	15	10	20	4	16	4	1	10	5	3	3
c2a	7	18	19	24	2	10	2	2	8	4	1	3
c2c	5	22	14	20	2	12	3	2	5	9	2	2
c2d	-	16	12	22	-	13	7	-	10	19	-	-
c3a	3	18	17	19	4	15	1	3	8	9	1	3
c3b	6	19	6	14	7	10	1	4	7	16	4	-
c3c	10	22	11	21	3	7	2	3	5	7	3	4
d1	14	21	5	15	1	18	2	3	3	8	3	4

*Distribution in percentage over countries per research topic (horizontally adding up to 100 percent). Topic c2b has been omitted, as this sector has been included in the T(arget) projects.

Projects had to be submitted within specific research topics or categories. The different categories are listed in table 2. For the purpose of this communication a simplified listing of the projects is used: Infrastructure, industrial, botanical, zoological and preanormative. This breakdown differs from the official categories: infrastructure & databases, enabling technologies, cell biological technology and praenormative research.

However, the total number of categories is too cumbersome to be used in a short paper like this. Sector a is made up of projects on information/infrastructure. Enabling technologies are split out in protein design (cat. b1) and biotransformation (cat. b2). These together with fysiology and molecular genetics of microorganisms (cat. c1) form the essence of industrial biotechnology. Officially cell biology is made up of fundamental biology of plants and related organisms (cat. c2), and biotechnology of animal cells. The first is made up of the categories c2a: sexual reproduction, flower induction, gamete recognition; c2b: cell regeneration; c2c: molecular interaction between plants and related organisms, host choice, defence mechanisms, bacterial-plant interaction and c2d: fysiological properties of crops. Animal cell biotechnology is constituted of manipulation of cell and culture technology (cat. c3c), animal genetics (cat. c3b) and husbandry; improvement of immunity by rDNA vaccins (cat. c2c). The praenormative research is limited here to the in vitro evaluation of the toxicity and farmacological activity of molecules. The biological safety research will also fall within in this category.

It is clear that the presence of submitted industrial biotechnology oriented projects is of the same order of magnitude as that of the agricultural biotechnology oriented projects.

National Participation in N-Projects

All EC countries participate in the infrastructural projects with important activities as the culture type collection network, the protein structure databank, EMBnet, EMBL databank etc. These projects are set up in such a way that these tools are a service to all participants.

In industry-oriented projects the FRG dominates the participation in categorie b1 and b2 while Great Britain has the largest share of c1a. In botany-oriented projects GB makes up nearly a quarter of all participants in c2a, 20 percent in c2c as well as in c2d. France and Great Britain dominate the zoological sector, while France and West Germany contribute 40 percent of the participants in the praenormative research.

Another way of looking at the submitted projects is comparing the national participation in a category with the overall averages per category (Table 4). In the FRG but also in Portugal, Greece and Spain the industry-oriented participation forms approximately 50 percent of the total, while participation from Denmark is relatively below the average of 43 percent. Botanical projects are important in France, the Netherlands and Great Britain and less so in Greece. Zoological orientation is found in Denmark and Italy but is very low in Germany and Portugal.

Table 3. Numbers of Participants and Submitted Projects in the Different Categories As Well As the Number of Projects Nominated for Funding

Categories	Participants	Projects	Nominated Projects
Databanks and infrastructural projects (categories a1 and a2)	77	18	9
Industry-oriented projects (b1, b2 and c1)	674	140	16
Botany-oriented projects(c2)	393	64	11
Zoology-oriented projects (c3)	292	67	9
Praenormative projects (d1)	132	33	8

Table 4. Percentual distribution of the presence of "submitted participants" in the different categories per country (vertical adding up to 100 percent)

	Belgium	France	Netherlands	UK	Denmark	FRG	Portugal	Greece	Spain	Italy	Ireland	Others
Databanks and infrastructural projects (categories a1 and a2)	5	2	2	5	14	7	3	8	4	5	3	5(?)
Industry-oriented projects (b1, b2 and c1)	40	35	40	39	32	49	52	50	48	35	41	43
Botany-oriented projects (c2)	23	33	40	34	24	22	30	14	26	30	26	25
Zoology-oriented projects (c3)	16	20	16	17	28	12	8	18	17	23	18	18
Praenormative projects (d1)	16	10	2	7	4	9	6	8	5	7	10	8

T-Projects

In T-projects a large number of laboratories cooperates around a central theme. The T-projects vary considerably: Lactobacillus, Lipases, Arabidopsis, Yeast genome sequencing, Plantcell regeneration are the themes that have been chosen. Automated bacterial identification and Animal cell biotechnology are two other T-projects. The ins and outs of these projects are worth a closer look, but will not be dealt with here. In a number of cases T-projects are a continuation of the European Laboratory without Walls themes as run under BAP (Biotechnology Action Program). Therefore it does not make much sense to compare the participation of different countries in the different themes.

A total of 145 countries have been nominated for funding in the T-project areas varying from 26 in T5, Plantcell regeneration, to 37 in the Yeast genome sequencing.

Participation of the Netherlands

The Netherlands are fairly well represented by 11.4 percent of the participants. As regards the main contractors, the Netherlands score even higher (14.7 percent). The botanical section is clearly above average, both compared to the participation as a whole (Table 3) and as a reflexion of the greatest interests (Table 4). One should realise that these figures not necessarily reflect the Dutch R&D interest in biotechnology, but probably primarily the biotechnology network of the Netherlands and the way the knowledge of the existence of the BRIDGE program is spread through the scientific community. This implies that when the direction of the biotechnology research program is changed, the network has to be adapted as well.

Nominated projects

In N-projects 36 Dutch laboratories take part in 22 projects out of the 53 projects, with 267 participants, nominated for funding. In T-projects 25 laboratories take part out of a total of 145 participants in 5 T-projects.

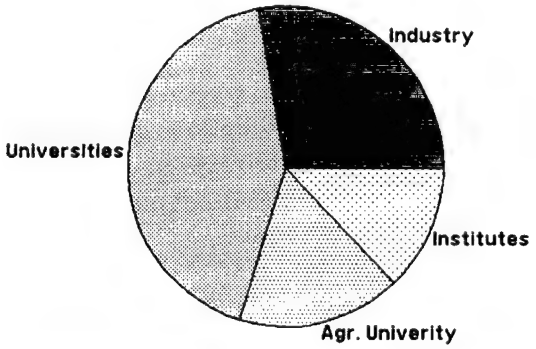


Figure 1. Distribution of Dutch participants in BRIDGE, nominated for funding in N- and T-projects

Two aspects have to be mentioned. As shown in Figure 1 we see for the first time a distinct participation of industrial laboratories. So far, European biotech programmes were of primary interest to the academic world. A second observation is the relatively high participation of the Agricultural University and relatively low participation of institutes. We intend to evaluate these results in more detail.

Germany: Poll Shows Resistance to Genetic Technology

91WS0002A Duesseldorf HANDELSBLATT in German 20 Sep 90 p 20

[Text] Handelsblatt 19 Sep 90—Only 20 percent of the FRG's population harbors "positive feelings" toward genetic technology. This was the result of a representative poll conducted by the Allensbach Institute for Public Opinion Research in 1989. Are genetic engineering companies doing too little too late to communicate their views to the public?

Genetic technology is a collective term for interdisciplinary fields of applied sciences encompassing chemistry, biology and process technologies. Many applications have existed for a long time. But the public is reacting adversely to the science of biotechnology in its entirety as a result of the one-sided emphasis on one of its components, genetic engineering. 68 percent of the German population display hostility toward the term genetic technology. The reason is simple: Industrial genetic engineering is associated with reproductive processes and tampering with human genetic material. And the trend in public opinion is not positive as a European study conducted in 1987 confirms. 45 percent of those queried said then that "genetic technology involves dangers that are unacceptable."

In a 1989 analysis on the acceptance of genetic technology, the scientist Jaufmann portrayed the phenomenon, unique to the FRG, in which a declining acceptance goes hand in hand with an increased level of formal education. But even in the United States, where more pragmatic attitudes prevail, the acceptance graph does not necessarily show an upward trend. The U.S. Office for Technology Assessment, in 1987, pointed to a considerable and serious awareness and information deficit with respect to genetic technology. In Japan, on the other hand, the results interesting: Despite an overall conservative and spurning posture, distinct differentiations are apparent. For example, 56 percent of the young women viewed biotechnology positively, thus the friends of genetic engineering outnumbered its foes.

If in a democracy a subject is fraught with ambiguous anxieties, the framework conditions deteriorate dramatically: The number of patent applications should serve as a suitable early indicator for this. Many risk-taking innovative research businesses do not judge the framework conditions to be particularly positive. Accordingly, the proportionate percentage of patent applications in Europe, 19 percent, is relatively low (see chart).

However, there will be no progress in fighting and preventing dangerous diseases without the methods and processes of biotechnology and genetic technology. Furthermore, estimates are available on how genetic technology would contribute to a decline in air pollution by 15 percent in Europe by the year 2000 (Cefic, 1990). Furthermore, a reduction of livestock manure by 20 percent would translate into ameliorating soil pollution by 200 million metric tons per annum if innovative methods and products of biotechnology were to be applied in current every-day agricultural life in Europe.

Despite goods reasons in favor of biotechnology in the broadest meaning of the word, the potential for indignation is rather high. When a risk is familiar, is taken voluntarily, and is considered to be under control—like driving a car or windsurfing, for instance—the potential for indignation is low. By contrast, modern processes of biotechnology in combination with complex technologies are subject to—because of their unfamiliarity—extremely high levels of indignation potentials.

The economic implications of biotechnology are so important that we cannot permit it to fall prey to confrontation in society—among politics, business and the population—and fail. For the sake of genetic technology, a dialogue among business people, politicians and the general population is imperative.

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Germany: Government Funds Genetic Engineering Research Program

90WS0094B Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 3 Sep 90 p 10

[Article: "'Glass Mouse' Will Substitute 10,000 Live Mice: Federal Government Spends 1.5 Billion German Marks on New Genetic Engineering Research Program]

[Text] Bonn, 2 Sep (dpa)—By 1994, the government of the Federal Republic of Germany will spend approximately 1.5 billion German marks to support R&D in modern biotechnology. According to Dr. Heinz Riesenhuber, Germany's minister for research and development, biotechnology will play a key role in fighting hunger and diseases. Following approval by the West German cabinet, Riesenhuber introduced the new program entitled "Biotechnology 2000." He pointed out that a genetic engineering law enacted for this purpose provides a "reliable framework" for the program. As a result of delays within the Economic Community, the appropriate regulations will enter into force on November 1 and not, as planned, on July 1.

In addition to securing funds for basic research, the new program is designed to promote research in the areas of the environment, public health and nutrition as well as energy and natural resources. Genetic engineering research will play a key role in this program. In the Federal Republic of Germany, there are already more than 1,000 laboratories involved in this new technology, with more than 10,000 labs operating worldwide. Four genetic research centers are located in Cologne, Heidelberg, Munich and Berlin, respectively. Riesenhuber appealed to the business community to become even more involved than before in this promising technology. Currently, 220 West German firms work with biotechnological processes, with most of them being medium-sized companies.

According to Riesenhuber, the most vital function of genetic engineering will be in the realm of pharmaceuticals. At present, only one of the 13 available genetic products are manufactured in Germany. Riesenhuber also attaches great importance to genetic engineering in the areas of plant cultivation and animal husbandry.

In terms of environmental applications, Riesenhuber mentioned as one of the many possibilities the development of microorganisms which, for example, would be capable of "cracking," and thus rendering harmless, the highly toxic chemical dioxin. Furthermore, there are potential alternatives to animal research in the offing, long criticized by animal advocates. In this context, Riesenhuber presented the "glass mouse," a device developed in two years by the University of Bochum (Northrhine-Westphalia) which is capable of producing one kilogram of monocloned antibodies essential for combatting diseases. This device substitutes 10,000 live mice. Antibodies are proteins produced by the body to fight foreign agents that have invaded the body.

Soon after Germany's reunification, biotechnology will also be promoted actively in the territory of the present German Democratic Republic. Research institutes and businesses there will be eligible to apply for grants from the research program. At present, nine joint projects exist in the field of biotechnology. The genetic engineering research center in Berlin will soon be expanded to include scientists from the GDR.

As for the Federal Republic of Germany's international standing, the minister remarked that "we are in the running in all important areas." The government program makes reference to this issue by maintaining that, whereas during the 1970s the FRG was considered "a biotechnological no-man's land," German biotechnology R&D has achieved "a high-ranking position among the industrialized countries," as a result of increased government support. To be sure, the United States and Japan remain at the top.

Germany: 'Biotechnology 2000' Research Program Summarized

91MI0001 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 31 Aug 90 pp 2-4

[Excerpts] On 31 August 1990, the Federal Government approved a new biotechnology research and development program known as "Biotechnology 2000."

The program's financial allocation for the period 1990-1994 will total DM1.5 billion, a 50 percent increase over the previous five-year period, when funding for biotechnology amounted to DM1 billion.

In addition to this, the Genetic Engineering Act, which came into force on 1 July 1990, has now cleared the way for innovations in industry. This act has both created a firm legal framework and laid down safety requirements. The first licenses are now being granted, some of them still under the federal law governing release into the environment. According to industrial sources, applications for licenses under the Genetic Engineering Act to produce about 16 genetic products will soon be submitted. The Biotechnology 2000 program and the Genetic Engineering Act will give biotechnology and genetic engineering a strong boost, in both scientific circles and industry.

Biotechnology, and genetic engineering in particular, are currently of greatest importance in pharmaceutical research. Other areas of application with potential for fundamental innovations include agriculture and environmental biotechnology.

Pharmaceutical Research

Genetic engineering processes are already used to extract medical products such as antibodies to fight infections, antitumor agents, cardiovascular agents such as tissue plasminogen activator (t-PA), which is responsible for dissolving clots in the blood stream, wound healing factors, hepatitis and herpes vaccines, human insulin, the human growth hormone, and the blood clotting factor. Genetic engineering has made available, in sufficient quantities, a new class of therapeutic substances (proteins, hormones) for pharmaceutical preparations. What have so far been considered unavoidable foreign infections can now be prevented. For example, the genetically-engineered blood clotting factor cannot possibly carry the hepatitis or AIDS virus, because it is not produced from human blood. Vaccines are no longer made from attenuated viruses, but from "genetically-neutralized" viruses or virus fragments that can trigger the required activation of the immune system (formation of antibodies) without causing a real infection.

One reason why only one of the 13 genetic products available on the world market is produced in the FRG is that production based on genetically modified organisms was inadequately regulated in the past.

Agriculture

If the molecular mechanisms underlying the natural control of growth and the differentiation processes involved in plant and cattle breeding

are understood, a targeted increase in product quality and genetically-induced resistance to disease and pests can be obtained. As far as plants are concerned, a particularly important factor is the extent to which they can be used to produce industrial raw materials (carbohydrates, oils, fats) or to grow crops under extreme conditions, such as aridity, saline soil, heat, or cold. As far as animals are concerned, priorities include the development of methods to replace animal testing, animal health, and the development of diagnostic procedures and vaccines.

Environment

Biotechnology has already produced some outstanding achievements in the environmental sector. The biological degradation stage is now standard practice in every urban sewage treatment plant. Highly polluted industrial waste waters still pose problems, although here too microorganisms should help to break down persistent chemical compounds and eventually integrate them into the natural biological cycle. In many cases, these processes generate energy more than sufficient to cover the power requirements of the treatment plant itself. The air in the proximity of foul-smelling production processes is made odorless by various biological exhaust filters.

[Passage omitted]

The Biotechnology 2000 research and development program approved by the federal government will reinforce the trend begun in 1982. After the unification of the two Germanies, research institutes and industrial applicants in eastern Germany will be eligible to take part in the program. The opening of the frontiers has already boosted scientific contacts between the two Germanies. The BMFT [Federal Ministry of Research and Technology] has promoted cooperation projects and measures preparing the way for the integration of biotechnology research facilities. These initiatives include:

- Biology-related license projects;
- Access to the Gene Center in Berlin for teams from Humboldt University (East Berlin) and institutes in what is currently the GDR;
- Joint priority program sponsored by the BMFT and the Chemical Industry Fund to subsidize top scientists from the present GDR (DM5 billion);
- Partnership agreement between the Biotechnological Research Association (GBF) in Braunschweig and the Central Institute of Microbiology and Experimental Treatment (ZIMET) in Jena.

The Program's Priorities

The program's main objectives are to provide a secure technological foundation for the next century by promoting biotechnology and to work out the environmental solutions needed. The program comprises 12 priority areas:

- Development of methods and procedures;
- Cellular biology research, gene structure, and gene regulation;
- Photosynthetic production of substances, biological production of hydrogen;
- Synthetic biology, protein design;
- Neurobiological research;
- Biological systems;
- Plant breeding and plant protection;
- Renewable raw materials;
- Biology of waste disposal procedures;
- Alternatives to animal testing;
- Biological safety research;
- Technology impact assessment, ethical issues.

Primarily the program will subsidize research and development work focusing on the targeted study and exploitation of biological processes at the molecular level. Funding will cover application-oriented basic scientific research and the investigation of technological application potential in conjunction with industrial research.

Funding will be provided for new approaches to photosynthetic procedures, the synthesis and degradation potential of microorganisms and plants, and research into the biomedical basis of pathological processes in human beings and animals.

Research into gene structures and their functions, including cellular regulation mechanisms, creates the basis for an understanding and targeted exploitation of these natural processes, including the development of new solar energy exploitation techniques (e.g., "Biological Hydrogen and Production of Biomass"), the "design" of biological catalysts (proteins) or complete biological conversion processes ("Metabolic Design"), and the development of new drugs with targeted action ("Molecular Modelling").

At the GBF and other major research facility institutes, funding is provided within the institutional framework, while it will take the form of BMFT project subsidies for the gene centers, priority projects, and joint projects.

Genetic Engineering and Ethical Responsibility

The federal government wishes to help render the debate on the application of biotechnology and genetic engineering more objective and to promote discussion, especially of the topics that need to be aired in public. The federal government took early steps to promote interdisciplinary clarification of the scientific, legal, and ethical issues that new technologies raise by instituting:

- A working group whose results and recommendations were embodied in guidelines for subsequent political decisions on in vitro fertilization, genome analysis, and gene therapy;
- The joint federal and Land Genome Analysis Working Group to address the legal aspects of applying genetic diagnosis methods to human beings;
- The BMFT Genome Research Working Group, which is carrying out an interdisciplinary study of the ethical and social aspects of human genome research;
- The BMFT proposal for a meeting of EC research ministers and representatives of the EC Commission for an exchange of views and experience on questions of ethical principle relating to embryo and genome research and its application potential;
- The BMFT Committee of Experts on Neurobiology/ Brain Research, Neural Computing, and Artificial Intelligence to study the area where neurobiology and brain research overlap with computer science.

Germany Adopts New Genetic Engineering Program

90MI0377 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 5 Sep 90 p 4

[Text] Biotechnology has a wider variety of applications than almost any other field of research. They range from human medicine through plant and animal breeding and biomass production to environmental engineering. The University of Bochum has tested a particularly interesting example of what biotechnological methods can achieve: Whereas some 10,000 mice were previously required to produce one kilo of monoclonal antibodies to protect the human body from antigens, scientists have succeeded in using a biotechnological process to produce monoclonal antibodies, or in other words homogeneous proteins that protect the body invading antigens, in a glass container. Launching the federal government's "Biotechnology 2000" research and development program last week, Dr. Heinz Riesenhuber held up this device, known as the "glass mouse," as a prize exhibit. Under this program, the federal government will subsidize research and development on biotechnological processes and product that involve genetic engineering over the period from 1990 through 1994. In this four-year period, the BMFT [Federal Ministry of Research and Technology] will spend DM1.5 billion. This is half as much again as in the last five years.

According to the Federal Research Ministry, there are to date more than 1,000 laboratories, working with genetic engineering methods in the FRG and more than 10,000 worldwide. At present, biotechnology's greatest significance lies in pharmaceutical research. In the FRG 22 companies, 85 percent of which are classed as small and medium-sized businesses, have introduced biotechnical methods in the plant breeding, food technology, and chemical product and engineering sectors. The federal research minister expects further important innovations in agricultural and environmental technology applications within the next few years. Referring to the international position of FRG research, Dr. Riesenhuber said, "We are in the running in all relevant fields."

Of the thirteen pharmaceutical preparations at present on the world market that have developed out of genetic engineering research, only one is from the FRG. The Federal Research Ministry points out that, with the founding of the four genetics centers in Cologne, Heidelberg, Munich, and Berlin as a joint scientific, industrial and state initiative, genetic engineering had become firmly established in the Federal Republic. More than 50 young scientists are now working in those centers. According to Dr. Riesenhuber, it has thus already been possible to recover lost ground in some areas of applied biology and biotechnology.

COMPUTERS

Hamburg Firm Announces New OCR System

90WS0090A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 6 Aug 90 p 10

[Article: "Stielow: Applications in Vast Document Management Tasks"]

[Text] According to its own statements, the Horst Stielow Electronic System Copmpany of Hamburg has made "decisive progress" in automatic text recognition. With its Paratexer program package, this commercial company is marketing a system which should be able to read different typewritten or printed texts into a computer for further processing "with previously unheard-of relaibility." It is said that this will open extensive opportunities for streamlining for archives, libraries, and any institutions which have to manage extensive bodies of material.

The company claims the sophistication and power of the parallel-computer architecture of this new program package will enable the system to overcome all previously known restrictions for OCR systems [optical character recognition]. This means that the system is not tied to specific typesscripts. For example, the company says that Paratxer reads all known typewritter fonts that have been on the market since 1931. Wether it is a financial newspaper from the United States or a news magazine from Germany, a technical journal from Holand, or a

fashion journal from Paris, the new program package can handle a printed media, reports the company.

Paratexer can automatically process headlines and running text even when they are set using different fonts. The program has been "trained" to have wide-ranging reading ability. This training used the most sophisticated methods of pattern recognition. Variations in the font image no longer require adjustments by the user. The error rate, at 0.25 percent, is very low.

According to Stielow, a personal computer of the AT class is sufficient for using the Paratexer suite of programs. Such computers are already standard equipment in many offices. A scanner first enters the text into the computer as a complete image file. The Paratexer parallel processors are inserted into the main computer. They convert this file into text characters that can be sent back to the main computer (or another personal computer). These text files are then available for computer evaluation. They can be additionally processed in any way.

Complex quantities of data can be automatically filtered to find specific information. One method for doing this is by entering search terms. Stielow sees potential applications primarily in the entire area of archives. Whether it is a publisher's archive containing hundreds of thousands of newspaper excerpts, the information bureau that stores all commercial register excerpts, or the data base that keeps technical articles available for the experts, they can all eliminate time-consuming retyping of existing text.

Germany To Fund Upgrades in Data Base Programs

90WS0090C Duesseldorf HANDELSBLATT in German 16 Aug 90 p 8

[Article by Konrad Buck, "Data Bases / Technical Information Program of the Federal Government continued"]

[Text] On 9 August, the Federal German Government passed a new DM2 billion program to improve the infrastructure of the German data base market. This should accomplish two objects: The providers should cover their costs, and a higher degree of utilization by users should be achieved. The Federal Minister of Research, Heinz Riesenhuber, promised major support money for data base utilization. This money was earmarked in particular for small and medium-sized companies.

Data base providers must continue to beat the advertising drum loudly in order to draw attention to the service they offer. To this end, the Federal Cabinet just passed the "Technical Information Program (FIP) 1990 - 1994." The object of this program is to increase the utilization of data base services and continue improvement in the infrastructure of these services over the next four years.

On the vital importance of technical information, the Federal Government already launched the predecessor project "FIP 1985 - 1988" in 1985. At that time, DM1 billion were provided. In the meantime, an independent consulting company prepared a study in the form of an intermediate report. This study assesses the government support as beneficial. It emphasized the high annual growth of the German market for information services of about 6% in printed and around 25% in electronic media. The annual growth rate of data base utilization in the Federal Republic of Germany now is, at just short of 30%, considerably higher than, for example, the USA at 18%. The "Beilstein" and "Gmelin" are considered the foremost reference works in the area of chemistry. Transferring them to data bases and providing the German and international patent data bases, among others, produced a considerable improvement in the service. Even the commitment of private companies in the area of economics information, such as the Genios data base of the Handelsblatt Verlag, increased considerably.

In the meantime, STN International (Scientific Technical Information Network) also has assumed a leading position in the world market. STN International is a joint effort of three national providers supported by the BMFT. These providers are FIC of Karlsruhe, Chemical Abstract Service in Columbus, Ohio, U.S., and the Japan Information Center for Science and Technology in Tokyo.

In spite of the attractive offer, there has not been a run on the data bases. When measured against the sales of German providers of printed information products, the fraction for electronic products is paltry. The former stands at 20 billion dollars (1989) while the latter is 75 million dollars. The FIC of Karlsruhe was able to book about 360,000 research accesses in 1989. However, compared with 25,000 small and medium-sized companies doing research that are reliant on technical information, the group of users is still much too small. For this reason, the BMFT is betting that its new support program will make research in electronic knowledge banks more to the taste primarily of medium-size companies.

According to the minister, BMFT support for the research cost in data bases should be a "start-up incentive." For online research up to DM10,000, the BMFT assumes 50% of the cost. The companies will truly get up to speed with the help of education for technical personnel. Any firm training its employees to become competent bloodhounds can spend up to DM90,000 and receive 50% of this amount as a grant.

Obstacles to potential users are the lack of knowledge regarding the expected costs, and difficulties in using the data bases. Without hardware and software knowledge, the user usually stands helplessly before the data source praised as so rich. However, it takes time for this well to start gushing, that is, until it supplies the needed information. By then, the user has looked through many pages without results and has paid for many minutes of connect time for nothing.

Because of this, the future customer must first be led to the "pool of information." One fact proves that this is necessary: A total of 60% of all patent applications in the Federal Republic of Germany must be rejected by the examiners of the German Patent Office in Munich because they are not new. However, adequate research of the state of the art requires the inventor to shuffle through about 4 million technical publications per year. This is about 20,000 documents per day. Such a search is only economically feasible by the consistent and competent utilization of data bases.

Have the Research Done

Data bases are to a large extent "unknown" to 55.8% of the 893 companies polled by the Rationalization Board of Trustees of the German Economy (RKW) in Bavaria. The cost, according to 11.2% of the companies, is rated "very high" and "high" by another 60.9%. It is no wonder that data bases are at the end of the line (together with the EEC and OECD) among sources of information. They trail far behind the usually cited technical literature, customers and suppliers, fairs and conferences. Although 15.4% of the companies believe using data bases is "very good" and another 54.2% consider it "good," many do not trust themselves in the systems. Only 13.7% do research themselves, 21% leave it to the various intermediate agencies. Small and medium-sized companies use data bases directly and indirectly considerably less than large companies. However, of these large companies, only 31.9% use data bases themselves while 44.4% would rather leave it to the professionals of the intermediate agencies.

Germany: Active Processor Probe for Software Analysis

90WS0087A East Berlin NACHRICHTENTECHNIK-ELEKTRONIK in German Jul 90 pp 258-261

[Article by F. Richter, Technical University of Dresden, Information Engineering Section: "Software Analysis on the i8086"]

[Text] With the increasing number of special solutions even in 16-bit technology (e.g., for industrial and other controllers and for real-time data processing) as well as the need to analyze microprocessor systems in the service sector, the demand has emerged for high quality testing and measurement technology.

Unfortunately, elementary testing means often continue to dominate our practice. For a highly complex measurement device such as the logic analyser to enjoy broad use, its operation must be user-friendly and, at the same time, it must offer complex capabilities both for test setup and for evaluation in order gain user acceptance. The solution presented here fulfills these requirements while attempting to retain universality.

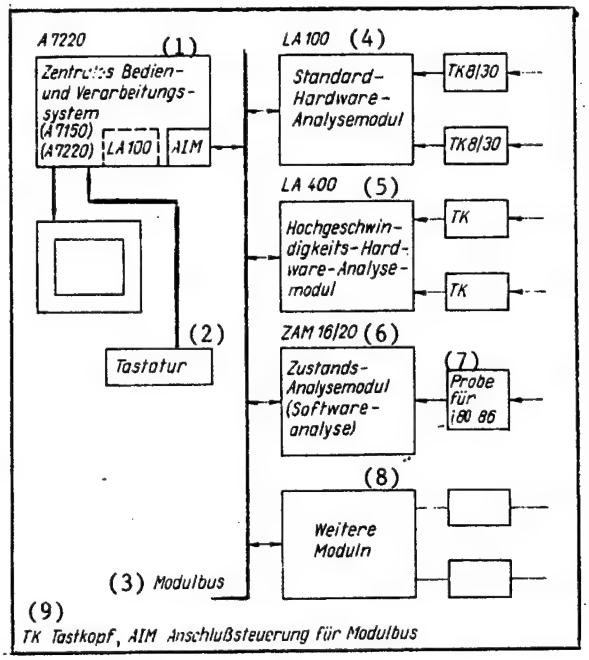

Figure 1. Configuration of the modular logic analysis system (TU Dresden)

Key: 1. Central control and processing system—2. Keyboard—3. Module bus—4. Standard hardware analysis module—5. High-speed hardware analysis module—6. Status analysis module (software analysis)—7. Probe for i8086—8. Additional modules—9. TK = Probe, AIM = Module bus interface controller

1. Design

The active processor probe (APP) for the i8086 microprocessor fits organically into the modular logic analysis system which was developed at the Technical University of Dresden but is in principle adaptable to a variety of logic analysers. Figure 1 illustrates the integration of the APP into the modular logic analysis system. The presence of an MS-DOS PC to serve as the control and processing system is essential. This smooths the way for user-friendliness and flexibility in test setup and evaluation.

Absolute modularity was designed into the software so that, if necessary, sections of the software package can be eliminated to permit adaptation to other operating systems and host computers. The software was created in the C programming language, well-known for its high level of portability. The operation of the entire program package is executed according to an initialization file which determines the current configuration of the package.

2. Probe Hardware

Bibliography item [1] contains a thorough description of the APP hardware; therefore, the details need not be presented here.

Basic features implemented with the APP are

- The APP has two modes of operation—the bus mode and the command mode. In the bus mode, the image of the bus activity of the i8086 enters the analyser interface; whereas, in the command mode, the processor-internal queue is simulated so that only the commands actually serviced by the execution unit of the i8086 reach the logic analyser.
- The APP makes available all relevant processor signals, including all status bits as well as any auxiliary signals of the probe-internal logic.
- A strobe pulse is generated enabling acceptance of the signals by the logic analyser interface in the status analysis mode of the logic analyser.

3. Logic Analyser Specifications

The basic specifications for the logic analyser are

- Status analysis mode, 10 MHz external pulse,
- at least 48 input channels.

The 52 channel requirement for the logic analyser specified in [1] can be corrected because 48 data channels are considered adequate for adaptation of the logic analyser for capture and processing of the full data stream of the CPU being analyzed. The number of channels is highly significant because in many logic analysers the input channels are combined into 8- or 16-bit-wide groups. Thus 6 (8-bit) or 3 (16-bit) channel groups can be fully utilized—which is advantageous for hardware configuration or for setup (e.g., a small number of data models under complex trigger conditions). The following signals or signal bundles are used:

- address bus (A19 through A0)
- data bus (D15 through D0)
- status bits (/S0 through S5)
- signals LOCK, EU/BIU, TEST, STBIT0...STBIT2 (see [1]).

The presence of at least 3 qualification inputs for the external clock is advantageous to permit performance of a hardware-based preselection of data on the basis of the status signals /S0, /S1, and /S2 generated by the microprocessor.

4. Program System Structure

In all sections of the program system (also called dialogs), it is possible to branch off from a common menu line. Is possible to switch arbitrarily between the dialogs as long as the requisite conditions are met (e.g., in an evaluation dialog, it is only possible to branch when test results are present). The menu line functions both in the text mode and the graphics mode.

5. Test Setup

Test setup uses a dialog in which the user has the capability of implementing the following settings:

- Trigger type. The existing program package permits the selective use of the trigger types: Address triggering, data triggering, bus cycle triggering, segment register use triggering (i.e., based on status bits S3 and S4 of the i8086) as well as triggering by the interrupt enable flag (S5) and by the active status of the TEST pin of the CPU.

In address triggering, address values whose occurrence triggers a stop in the analysis can be entered (for example, in the form 1000H:0200H). Hexadecimal (H), binary (B), and decimal (D) values are permitted; with binary and hexadecimal input, there is the capability of masking individual bits or address sections. This is done by entering an "X" in place of a digit. For example: FXXXXH—triggering on all address values in the range from F0000H through FFFFFH, 1010 0101 1010 0101 101XB—triggering on A5A5AH and A5A5BH.

Triggering on data words occurs in the same manner.

Triggering on a specific bus cycle type from the group of bus cycles occurring is also possible (for example, interrupt acknowledge, I/O read, I/O write, halt, instruction fetch cycle, memory read cycle, memory write cycle, passive).

This type of triggering is based on the CPU status signals /S0, /S1, and /S2.

Triggering by the use of a specific segment register is also possible (the relevant statuses are found in status signals S3 and S4).

Bus cycle triggering and segment register use triggering are simple for the user to select from lists of choices offered.

The active status of the test pin and the interrupt enable flag of the CPU can also be used for triggering.

Command triggering is planned for other versions of the program package. This very user-friendly triggering capability definitely requires a logic analyser with complex triggering (data-dependent branching, returns, and parallel monitoring of multiple trigger words are basic conditions).

- Data reduction. It is not always necessary to log all cycles initiated by the CPU. Therefore, a relevant subset of the group of bus cycles can be selected. However, one consequence of this method is that in the reassembly of the data track obtained by measurement, it may not be possible to represent the relevant bus cycle, or if no instruction fetch cycle is displayed, it may not be possible to execute the reassembly.
- Bus mode/command mode. The respective logging mode of the processor probe is selected.

- Repetition factor. With this menu item it is possible to specify how often the triggering event in use must occur before analysis is stopped. It is possible to enter from 1 to 256 events.
- Delay. After triggering occurs, it is possible to continue to wait a certain number of pulses (each pulse corresponds to a bus cycle to be logged) before analysis is stopped. Possible settings range from 1 to 4096 pulses.

6. Evaluation Software and Tools

The evaluation software is absolutely modular in design. High user-friendliness is achieved by means of a built-in help system accessible from any menu item. The evaluation software offers the following capabilities:

- Tabular presentation of measured data. The data logged in the measurement memory of the logic analyser are presented on the screen of the control and processing system in table form arranged according to logical signal bundles. This presentation form is relatively reliable for evaluation, i.e., with so-called "address" or "data clamps", a presentation of results which permits meaningful evaluation is offered. The tabular presentation can be used in both the bus mode and the command mode of the processor probe, i.e., irrelevant bus cycles of the CPU can also be logged if necessary.[1]
- Mnemonic representation of measured data. The status signals /STBIT0, /STBIT1, and /STBIT2 are generated by the processor probe operating in the command mode. Using these as well as /BHE and A0, it is possible to uniquely identify each command sequence from the data track logged. Thus, clear synchronization of the reassembler with the measured data track is possible.

Reassembly is performed using the following algorithm:
a) search for the first occurrence of an FBO (first byte of operation code),
b) completion of the command in a buffer (i.e., search for the next FBO),
c) generation of the command mnemonic and of operands, if necessary,
d) test for associated bus cycles (includes the test for REP commands which require a large number of bus cycles),
e) output of the data obtained into a buffer file.

Processing continues with this algorithm until the supply of measured data is exhausted.

- Memory profile presentations. Two types of memory profile presentations are provided—global memory profile presentation (survey of the entire main memory from 00000 through FFFFFH) and detailed memory profile presentation which displays small sections of the memory (can be shifted throughout the entire main memory). In both types of display, the map of accesses to the main memory is presented as a histogram. The display is under full graphics. A search function to locate accesses in the address space is implemented.
- Printer output of test results. In addition to the capability of producing a hard copy of the current screen at any time, the capability of complete output of the tabular or mnemonic display to a printer is offered.
- Editing function. The objective of this function is to simplify documentation and archiving of test results. A text editor selected by the user (the editor call is defined in the configuration file) is initiated by a text file which can contain either the data of the mnemonic or the tabular presentation. For this, the user can fall back on the familiar environment of his own text editor to add comments, separate subprograms and loops, etc.
- Storage of setup and measured data. Because storage takes place in a very compact form, the files created have a maximum length of approximately 8K bytes. They include both the measured data and the associated setup.
- Help system. The help system is accessible via the menu line and offers several screens of information about the use of the program system, the evaluation software capabilities, and the error messages of the communications interface to the logic analyser.

7. Software Performance Analysis

Software performance analysis is gaining increased significance. Particularly with real-time applications, existing products do not offer the programmer any capability of correctly determining the run time of his programs or their efficiency, or this is only possible at great expense. The software performance analysis offers a useful alternative to this.

For this, in contrast to the above-mentioned evaluation processes, real-time reference to the logged measurement data is necessary. It is customary to log a multidigit binary counter (asynchronous to the strobe pulse) with a high clock rate ($T \leq 100$ ns) with each strobe pulse of the logic analyser. This counter can either be added on to any logic analyser as an external module or be located within the device itself. Word widths from 24 to approximately 48 bits, depending on pulse frequency, are customary internationally. Such modules are capable of producing real-time references for periods up to hours and days. Thus, analysis of large program systems (for example, process controllers) under real conditions is possible.

Tabular forms and, preferably, graphic representations are used for evaluation processes.

The program system to support the APP offers the presentation of run times in program sections, their temporal sequence (advantageous, for example, in the

analysis of systems with many interrupt sources) as well as access to specific memory cells. Furthermore, accesses to address areas outside the user program can be analysed. Among other things, analysis of the time consumption of an operating system is facilitated, or a test can be performed to determine the presence of computer viruses.

In all types of presentation, display is in full graphics in the form of bar graphs or strip charts. Interesting potentials for improvement of user friendliness are provided by the possible inclusion of the DEBUG information of a high-level language compiler or a macro assembler for definition of address areas. This method allows the user to work without precise knowledge of the location of the program sections in the main memory.

8. Test Process Cycle

The 'START' field is found in the test setup dialog. When this field is selected, a special dialog is called up—the trigger monitor. Here, the user can follow the individual phases of the test process and is informed, if necessary, of errors which occur. The individual phases of the measurement process are

- initializing the logic analyser hardware
- starting the test
- monitoring the progress of the test and, if necessary, manual stopping in the absence of the triggering event selected
- transfer of test data to the host computer.

This terminates the test, the user is informed of the number of events logged, and the program system returns automatically to the test setup menu to permit the start of a new test with corrected parameters, if necessary. It is possible to branch into any evaluation menus desired.

9. Adaptation of the APP to Logic Analysers LA100 and A7220

Logic analyser LA100 (Technical University of Dresden, Center for Scientific Instrument Engineering and Research Technology—ZWGB) is suitable for use of the APP. This is also true for the A7220 (VEB Electronics Gera).

A configuration with at least 48 test channels is required. The logic analyser enables testing of up to 1024 pulses (bus cycles) with the APP in the bus mode or the command mode. The present program package supports both test setup and various evaluation procedures. Software performance analysis is not possible because no real-time reference can be implemented with the present configuration of the LA100/A7220.

10. Adaptation of the APP to Status Analyser ZAM 16/20

Status analyser ZAM 16/20 (Technical University of Dresden, ZWGB) is an instrument specifically designed for status analysis which offers significantly more complex triggering capabilities and data selection mechanisms than the LA100. For example, it is possible to use a data area (subprogram) or a complex combination of signals as triggers. The ZAM 16/20 permits command triggering. Furthermore, data areas can be masked—particularly interesting for the use of the APP. The logging field with the ZAM 16/20 also includes 1024 events. Software performance analysis is possible if a "time stamp module" is included in the configuration.

11. Summary

With the APP for the microprocessor i8086, software analysis of relevant microcomputer configurations is possible using the program package described. Complex [text omitted in the source document] and software components of the user system. Compared to the standard software of logic analysis systems, the specialized program package offers the advantage of easier use because all settings are limited to the minimum required for the operation of the processor probe. Thus, the operator can restrict himself to the actual test process and is freed from superfluous information. Production of the APP 8086 is scheduled to begin in 1990 at the Center for Scientific Instrument Engineering and Research Technology of the TU of Dresden.

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FRG Company Developing Kernel of CAD System

90MI0343 Leinfelden-Echterdingen DIE COMPUTER ZEITUNG in German 8 Aug 90 p 6

[Text] Drawing board inventor Nestler is preparing to write CAD development history. As technology leader in the Esprit project CACID [Computer Aided Concurrent Integral Design], Nestler Electronics wants to launch a "CAD system of the future" as a joint venture with European partners. Engineer Rolf Schmidt has taken on a great responsibility for the next two years. However, his lively face expresses undisguised joy at the coup he has pulled off rather than the weight of a heavy load. In Brussels, this engineer from the small Black Forest town of Lahr, landed a really exceptional fish for the medium-sized company for which he works, the drawing board inventor Nestler: leadership of a CAD research project under the aegis of ESPRIT, the European Strategic Program for Research and Development in Information Technology.

Brussels is subsidizing developments on a European scale in the latest round of ESPRIT with ECU270 million (about DM556 million). Of the 449 proposals received, 227 were shortlisted and 40 of these were selected and established by contract, including the Nestler CACID project, which the EC planners are funding with ECU2.3 million. ESPRIT funds normally cover about 50 percent of development costs. ECU900,000 are on their way to Lahr from Brussels funds. Nestler is injecting an equivalent sum as its contribution to the project.

The aim of CACID is to create the prototype for an integrated design software solution that will encourage its users to work as a team, which is of the utmost importance.

The Need for Teamwork

Working procedures primarily require coordination where design work is carried out on a product in separate departments or by several colleagues. However, the current techniques that give preference to sequential processes of sequential procedures are hardly immune to breakdowns in communications. Wherever a wide range of different viewpoints, such as a client's wishes and manufacturability, performance and manufacturing process, existing solutions, and cost-effectiveness have to be taken into consideration, distribution of information sometimes suffers. Yet the lack of clarity rapidly sends many a brilliant idea to the scrap heap or acts as a brake on the design work. Against this background, Nestler's development engineers and scientists from the University of Karlsruhe's Institute for Computer Application in Planning and Design have for some time been considering how many of the concepts for future CAD systems can be built with existing technology and at reasonable expense. This has given rise to the idea of a team-oriented CACID system, with a view to concurrent operation, which should shorten the design procedure. The project is taking on a key role in the development of a new generation design system. Built to meet market demands, once completed the system will:

- be expanded to take in the preliminary phases of the design process;
- provide the development team with efficient, continuous communications by means of concurrent operation, and
- present complicated and complex developments as clearly as possible with a view to problem-free design.

Nestler will lead the CAD offensive; as the prime contractor, it will control the cross-border flow of knowledge and coordinate six European partners: The Alsatian special machinery builder Dessindus contributes its specific application know-how and the Spanish machine tool builder Danobat general application know-how to the project. The French Standardization Association AFNDR is responsible for specifications and standard solutions, the Austrian software house Fast covers standard and catalog CAD parts, and Italian engineering firm called Tecnation is contributing its accumulated knowledge of the market and end-users, while the software specialists from the British firm Kern will provide a universal three-dimensional modeler.

The FRG contribution comes from Nestler, with its own object-oriented NesCAD system, and the University of Karlsruhe Institute for Computer Applications in Planning and Design, with its sound knowledge of control and design methods. The "main part of the project," says Schmidt, takes place on the Rhine. The contract partners in Lahr, Karlsruhe, and Colmar are the prime technological movers. They must "make sure" says Rolf Schmidt, referring to Nestler's responsibilities in particular, "that everyone works together toward the target for two years and everything stays under control.

Philips Parallel Computer Research Described

90AN0383 Amsterdam COMPUTABLE in Dutch 29 Jun 90 pp 67, 69

[Article by Olof Koekebakker: "Innovation in the Netherlands: Parallel Computer Makes 'Ideal Filing System' Possible—Philips Research Has Produced Technical Solution; Commercial Version Is Now Expected"]

[Excerpt] The development of the parallel computer with its hundreds of autonomous, interconnected subcomputers signifies a clear break with the conventional Von Neumann architecture. Applications that had been unattainable with a traditional computer have become possible. Philips Research, one of the leaders in this field, is now working on the "ideal office filing system." Via "text matching" an enormous number of documents can be searched and selected on the basis of specific information. Assistant Director Nijman: "The technical solution is here. Now it just depends on when the customer wants it." [passage omitted]

The "ideal filing sytem" will be made possible by the parallel computer. It is very probable that in the near future this new technology will be influencing the office environment and there is a good chance that one of the products which will come onto the market will be from Philips. Philips Research Eindhoven has been very busy for some time with office applications of the parallel computer. Various research and development projects in this field have been undertaken with support from both the Dutch Government and the European Commission (see box).

Dr. A.J. Nijman, assistant director for information technology at Philips Research, declares that the applications still to be developed are not intended for environments where the emphasis is on standard procedures. For example, use of the parallel computer is hardly of interest in salary administration.

Absolutely No Chance

Nijman: "We are aiming at offices where to a large degree the work is unpredictable, such as the bank

department responsible for company strategy. Documents arrive in a continual stream and have to be put away in files and archives and among them items are regularly found which do not belong in any existing file so that the number of files is constantly increasing. When the most important archives are like that, then that is the world at which we are aiming."

The ideal archive is meant for the office worker whose daily stream of documents that could ever be of interest is so large that he cannot even browse them all. The principle of the ideal archive, in short, is this: Access the information at the moment you need it and not at the moment someone else finds it necessary to send it to you.

Someone who wants to find out about a particular subject must, on the basis of a short description, be able to extract everything from the (electronic) system: reports, newspaper and magazine articles, letters, etc. Nijman said: "Such work is so intensive in calculation and in input/output that an ordinary computer has absolutely no chance of doing it. An endless number of documents must be searched and compared and an enormous amount of storage capacity is needed. It is a system that needs precisely those technologies that Philips excels in: mass storage disks and parallel machines."

Distance Immaterial

The parallel computer developed by Philips plays a central role in the research program. The company is known for its development of a network system with hundreds of subcomputers (or nodes). In order to permit these nodes to communicate with each other, Philips has developed a chip which routes the messages through the subcomputer network. Going through only two other subcomputers, at most, the message reaches its destination quickly and efficiently. If particular routes are too busy, the communication processor automatically chooses another route—a patented invention which, according to Nijman, has made communication considerably easier.

In addition, the Philips research team has succeeded in overcoming a major problem which has until recently been inherent in parallel systems. Nijman: "Traffic in a parallel computer must be organised in such a way that a programmer no longer has to bother himself with it. He should only need to tell the system which part of the program he wants to be in; the hardware should then ensure that that is the part he reaches. We have solved this in such a way that it no longer causes a delay."

With the development of parallel computers, people have long been searching their heads over the "allocation problem." The main question here is how the different parts of a program should be organised on the separate subcomputers. According to Nijman: "The parts which 'talk' to each other should be kept close together; if possible, on two neighboring nodes. That has been a difficult problem on which a great deal of time has been spent and where a solution took a long time to be developed. We have been rather smart; we have made the allocation problem unimportant. We have stopped searching for a clever allocation but instead have ensured that distance no longer plays a role in our network. In this way, a whole class of problems has been eliminated." Using the basic technology developed by Philips, the parallel computer has unlimited extension possibilities. "It can be made as big or as small as you want, without any need to change the technology. You can, as it were, shape the parallel computer for whatever purpose you require," says Nijman.

In addition, the parallel computer can be produced from conventional elements. "No new physics technology is needed, although new discoveries could well be of value. You could, for instance, consider making such a commuications network an optical one. But that is an economic consideration and not my problem," continued Nijman.

The Philips technology even makes it possible to transform an existing conventional network of connected workstations into a parallel computer. Nijman said: "You can see such a network as one machine, in which the workstations are to be regarded as subcomputers. Much of what we have developed here can be used to program such a machine. That is a great strategic advantage; as a business we will soon not only be producing a box known as a parallel computer, but we will also be able to offer a specific functionality."

Bizarre Problem

Parallel technology has its price. Existing software can indeed be used (simply by running it on one of the subcomputers) but then the special properties of the parallel computer cannot be benefited from. Nijman: "If you really wnat to exploit parallelism, then you have to do something to the program. You cannot just program network computers in the same way as you would a conventional computer. Although there is usually a way round this, it is still a commercial disadvantage."

The essence of parallel computer programming is that the work be split into activities which can be processed simultaneously. Nijman: "We usually succeed in programming the parallelism in a particular application but a systematic method does not yet exist that could, for instance, be taught to others."

Nijman gave another example of an apparently bizarre problem which confronts the user of parallel technology. "How do you know when a program is ready? With an ordinary computer you can see for yourself when a program is finished. But you are never certain when that has happened when dealing with a subcomptuer in a parallel machine. Then the question arises as to when the subcomputer may revome the information from its memory. The whole understanding of memory management has to be altered. We have finally found an answer to these questions, but it does mean that you cannot just connect a few computers together. It does not work that way."

Understanding the Meaning

We come back to the office. According to Nijman, the parallel computer is preeminently suitable for text matching, that is to say the scanning of a large number of documents in order to select specific information from them. "Whoever wants to know about a certain subject writes a short description of it, about five lines, containing the particular information in which he is interested. The system then traces the documents which are most similar to this description."

In doing so the computer makes particular use of word frequency and intervals between words. Nijman: "You can get a long way using this simple technique. Naturally, a weighting factor must be built in; the occurrence of a word in a long document carries less weight than it does in a short one." The system can be made more intelligent by, for instance, allowing it to take into account the source of a document. It is even possible that one day the natural language technology will have progressed so far that the program will be able to "understand" the meaning of the text.

During its research Philips obtained access to the FINANCIAL TIMES database, in which all FT articles will soon be stored. An example: If all goes well, it should take only 20 seconds to be able to retrieve all the material on the (now proved false) rumors concerning a merger between two companies. Nijman: "The investor who is interested in this must write a small piece in which the names of the companies appear. He can then obtain all the articles which have any connection with them. There is one risk: He might call up something which is close, but in fact concerns something else; for instance, plans that these companies might have to purchase jointly a factory in South America."

Market Introduction

When will Philips be placing its office information system on the market? Nijman would say little ("I can only give the technical details") other than that the application possibilities are still being investigated together with the product division. It is, however, clear that the basic research has been completed. Nijman: "Technical solutions have been achieved. Now it depends on the precise moment when the customer wants it. Questions such as 'How perfect must it be?' and 'What should it cost?' are decisive. The last step in introduction to the market is by far the most expensive; 90 percent of the costs are incurred during the last year. That is when you must, for instance, start training the service department. What we have done up to now is nothing more than preparation for the last major financial effort." When asked how this particular Philips activity should be seen in terms of the world market, Nijman said: "In the field of parallel computers we are right at the forefront, although we are not of course the only company working in it. We know that because developments with parallel machines are hard to keep quiet. Anyone who will discuss it openly will not be allowed access to academic research, and that is something which is absolutely essential. I believe we are also the leaders in office applications, but there it is harder to discover what others are doing. In that area everyone keeps very quiet."

[Box, p 69]

Project Participation

Philips Research Eindhoven takes part in various projects in the field of parallel computer systems. The concern is project leader of TROPICS (Transparent Object-Oriented Parallel Information Computing System), a technology integration project begun in 1989 under ESPRIT II (European Strategic Program for Research and Development in Information Technology). The other contractors are Cap Sesa and Thomson-CSF of France, Delphi and Olivetti of Italy, and Nixdorf and Stollman of West Germany. The Universities of Amsterdam, Nijmegen, and Twente are subcontractors. The project will run until 1993 and is estimated at 700 man-years.

The aim is development of a parallel computer systm with hundreds of processors, intended primarily for office use. The project includes overall system design: the architecture, the Unix-compatible control system, and the programming languages. The starting point is the DOOM (Decentralized Object-Oriented Machine) systems concept.

POOL (Parallel Object-Oriented Language) wil be the most important programming language. Both were developed by Philips during an ESPRIT I project.

In addition, TROPICS will build on the technology developed in the PRISMA (Parallel Inference and Storage Machine) program. This project began under the auspices of SPIN (Stimulation Project Team for Computer Research), which focuses on three themes, one of them being "architectures" which contained such major programs as Neural Networks and PRISMA. The principal purpose of PRISMA is the development of an architecture which can effectively store and process both data and knowledge. One crucial part is the building of a PRISMA research prototype which can be used to develop the necessary concepts and techniques which will leasd to an industrial version. The four-year project, which began in October 1986, has a magnitude of 80 man-years and is estimated at a total cost of 25 million guilders.

Philips Research works in PRISMA together with the University of Amsterdam, the University of Twente, the Center for Mathematics and Informatics (CWI) in Amsterdam, the University of Leiden, and the University of Utrecht.

FACTORY AUTOMATION, ROBOTICS

ESPRIT II Project Standardizes CIM Testing

90AN0403 Brussels THE SPAG STANDARD in English Spring 90 p 6

[Article: "ESPRIT Project 2292 TT-CNMA"]

[Text] Testing Technology for Communications Network for Manufacturing Applications (TT-CNMA) follows on from the success of Phase 3 of ESPRIT Project 955 (CNMA), which developed the SPAG-CCT Test Tools for CNMA and ENE '88i. The TT-CNMA consortium consists of Acerli (France), Alcatel-TITN (France), BMW (FRG), Fraunhofer IITB (FRG), The Networking Centre (UK), Siemens (FRG), Televerket (Swedish Telecom), and SPAG (Standards Promotion and Applications Group, Belgium) as project coordinator. The CNMA project is not a member of TT-CNMA, but is contributing additional funds in return for the use of some of the results at the CNMA pilot site during the first quarter of 1990. The project wil last 32 months, involving 40 man years of work at a total cost of ECU 5,630,000, of which ECU 2,700,000 are funded by the European Commission.

Project Objectives

Interoperability Testing

To establish what is required for interoperability testing in a CIM environment and to develop prototype tools which will enable practical interoperability testing for the Manufacturing Message Specification (MMS) and the Network Management (NM) protocols.

Performance Measurement

In view of the tremendous potential benefits of performance measurement for users of CIM networks, some preliminary work will be conducted in this area with a view to establishing user requirements, performance principles and metrics definition.

Conformance Testing

To extend conformance testing coverage into new areas where standards are now stabilising and to demonstrate the feasibility of providing test facilities. Existing prototype conformance test tools will be further developed and demonstrated to provide tools for MAC Bridges (ISO 8802.3, ISO 8802.4, and ISO 8802.5), Routers (R21 and R22 functional profiles), Manufacturing Message Specification Interface (MMSI), MMS, NM, Directory Services and embedded testing of Session, Presentation and ACSE (Association Control Service Element) under MMS.

Technology Integration

New test tool developments will be compatible with the same harmonised environment in which the test tools developed during CNMA Phase 3 now reside. This work will be tackled in two parts. The first will focus on establishing a framework for harmonising current test systems, the second on determining the feasibility of using a formal test definition language (TTCN).

Support of CNMA Phase 4

Specific work programmes will be agreed in order to provide testing facilities in support of the CNMA project. Thereafter, the project will develop the required technology, complete trials and prove the ISW Stuttgart's industrial pilot facilities for use by the CNMA project.

The pilot facilities provided by ISW (University of Stuttgart) will be demonstrated to the public from July 1990 to January 1991 and will comprise many features of a production CIM environment. Indeed, the ISW pilot will be used as a "proving ground" for the true production demonstrators being planned by the CNMA Project ESPRIT II 2617.

In addition, in recognition of the importance of the European Commission's Conformance Testing Services (CTS) programme, specific links will be established between the two projects to ensure alignment of their respective work programmes.

EUREKA Automated Guided Vehicle Project Noted

90AN0382 Amsterdam COMPUTABLE in Dutch 15 Jun 90 p 5

[Article by COMPUTABLE correspondent: "EUREKA Status for Transtore Project From Has Automation Systems: Automated Guided Vehicles Come Within Reach of Smaller Companies"]

[Text] The Hague—At the recent EUREKA ministerial conference in Rome, the Transtore project from Has Automation Systems (HAS) was granted official EUREKA status.

The purpose of this project is to develop a flexible transportation and stock management system making use of sophisticated, computer-controlled vehicles. Transtore is mainly intended for use in warehouses of small- and medium-sized companies.

HAS anticipates a huge market potential for the Transtore system, which makes automated guided vehicle (AGV) technology accessible to small-sized companies. For this project, HAS is teaming up with the Institute for Applied Scientific Research (TNO) and the Greek companies Linardos and Amatron Industrial Automation Robotics. HAS will act as project leader.

The feasibility phase will take 18 months. During this period, HAS will play a key role, because the generic modules must then be specified. The research phase, which will be more application-oriented, is estimated to take 24 months. The Greek company Linardos will then step in through the implementation of a pilot project in Greece.

The Netherlands will also attempt to launch a pilot project during the feasibility phase. A Dutch flower auctioneering firm has already expressed interest in the system. The costs of the feasibility phase are estimated at 1.9 million guilders, 1.2 million of which to be borne by HAS.

According to the project proposal, TNO will act as a subcontractor for HAS, especially in the field of laser-guided vehicles. The accountancy and consultancy firm Arthur Andersen and the General Industrial Policy Department (AIP) of the Ministry of Economic Affairs have assessed this project favorably.

The Transtore system for the transportation and storage of warehouse goods will operate by means of intelligent, automated guided vehicles. In order to transport goods from one place to another on an horizontal plane (without any stairs or differences in level), these AGV's will be equipped with intelligent sensors and a multipurpose gripper device. The Transtore system will be fully automated, the operator's role being reduced to a minimum.

Only input and output will still require a substantial amount of human effort. The Transtore system is expected to become very intelligent through the implementation of database techniques for world modeling, product recognition, and stock management.

The system must also ensure that the AGV's follow the right track and that collisions are prevented. The project will benefit from the results obtained by other European cooperative technological programs.

For the development of man-machine interfaces, much is expected from the results of the IMPACT project conducted under ESPRIT II. IMPACT stands for "Intelligent Multi Media Interfaces for Process Applications in Control and Training."

The Transtore consortium also hopes to learn from the experiences gained with large-scale positioning systems using laser technologies. Such a system, named Capsy, is being developed by the TNO Institute for Building Materials and Building Constructions (TNO-IBBC).

Several prototypes are already operational. Initial results justify the expectation that they will be perfectly suitable for Transtore. HAS also has contacts with a small company which develops a self-learning, highly intelligent object-recognition system. This could be implemented both for world recognition in large-scale positioning operations and for product recognition in small-scale positioning. Finally, the project might benefit from the knowledge acquired by TNO within the framework of several ESPRIT-II projects and the EUREKA project CIMSTEEL.

Germany: FLOWER CAD/CAM System for Profiling Tool Manufacture

90WS0088A East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German Aug 90 pp 460-464

[Article by Doz. Dr.-Eng. J. Oswald, Dipl.-Eng. M. Hofmann, Dipl.-Eng. H. Launitz, Technical University "Otto von Guericke" of Magdeburg: "FLOWER—A CAD/CAM System for Profiling Tools"]

[Text]

0. Introduction

Profiling is a process for fabrication of profiles from cold or hot rolled sheet-metal bands or strips. By multiple stage shaping using profiling rolls (profiling tools) in a profiling machine, it is possible to fabricate the required product in any length. The process is characterized by high efficiency and productivity in the fabrication of extremely varied profile shapes (Figure 1). It can advantageously be combined with other production processes to provide continuously operating automated production lines.

The objective of the FLOWER CAD/CAM system currently under development at the Technical University of Magdeburg is the creation of a system for fabrication of profiling tools. For this, it is possible to draw on sound knowledge in the field of profiling[1] and to expand on experience with a first version PROMA.[2] PROMA is a general CAD/CAM system with which profiling tools for standard profiles such as V, U, Z, hat, tube, and box profiles in extremely varied dimensions can be designed and manufactured. It was developed cooperatively by the Rolling Mill VEB Eberswalde-Finow and the TU of Magdeburg and is used in the Rolling Mill VEB.

Whereas standard profile shapes represent a largely invariable assortment of products, industrial demand for ready-to-install special profile shapes and custom profiles will continue to increase. Rather large expenditures for design and technical preparation for production work against relatively small production quantities of these profiles. For this reason, it is worthwhile to develop a CAD/CAM system for profiling tools for special profiles, which will also permit processing of standard profiling tools. To that end, a new software concept was developed through interdisciplinary cooperation of the TU of Magdeburg. This concept is currently being implemented and will be presented in this article.

1. Modeling the Profiling Process

Various CAD and CAD/CAM systems already exist internationally for profiling. Solutions are known from companies and institutions in Japan, Canada, the FRG, Sweden, and other countries.[3-6]

The intended short-term goal of the new FLOWER system is a high degree of rationalization of the design and manufacturing process for profiling tools. The system is outstanding for its high technical expertise in the field of profiling, its user-friendly man-machine dialog system, and its efficient data manipulation and management. System structure and the relationships among the components are shown in Figure 2.

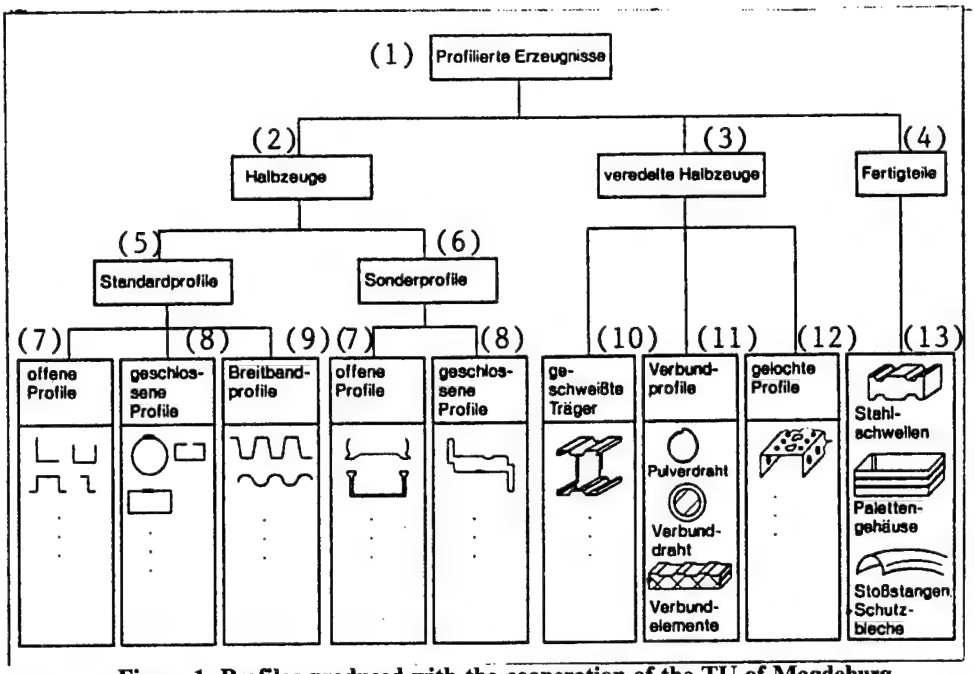

Figure 1. Profiles produced with the cooperation of the TU of Magdeburg

Key: 1. Profiled products—2. Semi-manufactured products—3. Improved semi-manufactured parts—4. Finished parts—5. Standard profiles—6. Special profiles—7. Open profiles—8. Closed profiles—9. Wide strip profiles—10. Welded girders—11. Composite profiles, Powder metal wire, Composite wire, Composite elements—12. Perforated profiles—13. Steel ties, Pallet housings, Push rods, Protective sheets

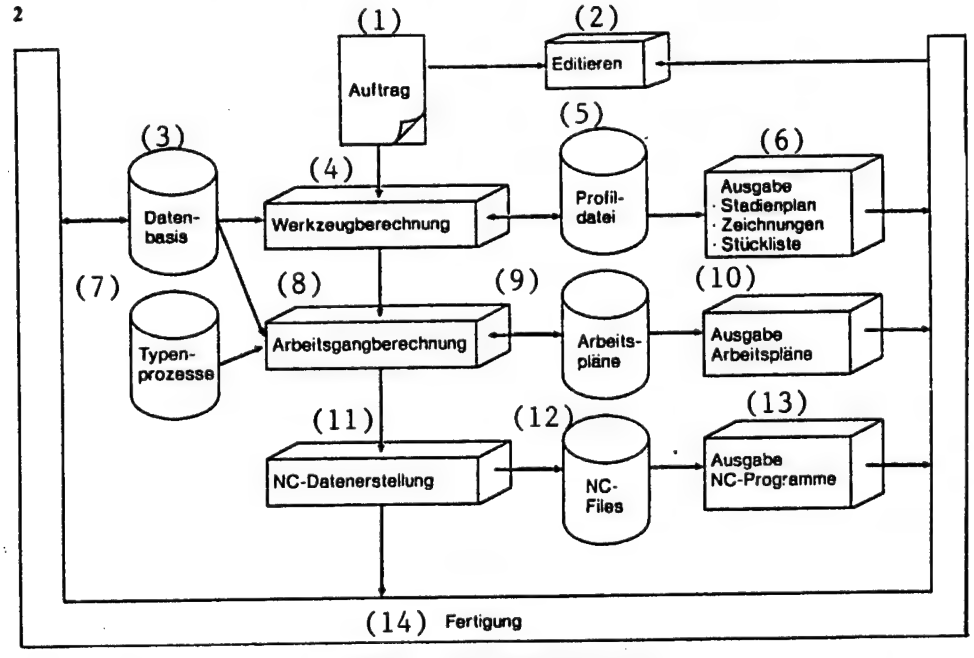

Figure 2. FLOWER structure

Key: 1. Order—2. Editing—3. Data base—4. Tool calculation—5. Profile file—6. Output: Plan for stages, Drawings, Parts list—7. Standard processes—8. Operation calculation—9. Operation plans—10. Output: Operation plans—11. NC data creation—12. NC files—13. Output: NC programs

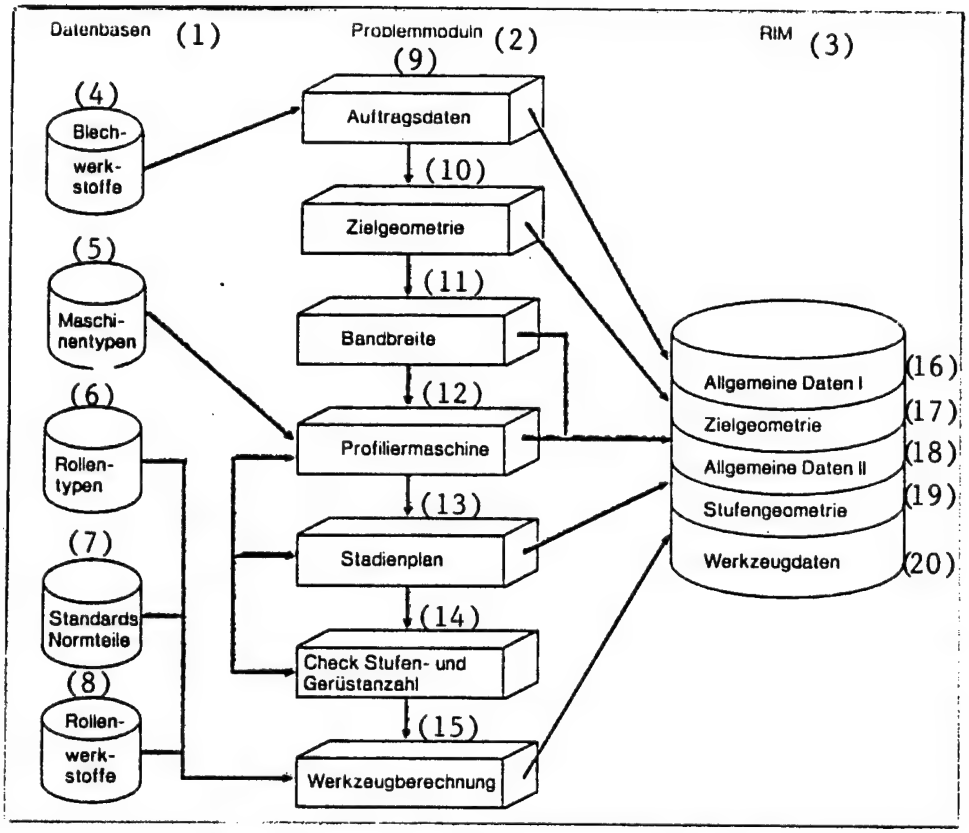

Figure 3. Excerpt from the program and data flow chart

Key: 1. Databases—2. Problem modules—3. RIM [computer-internal data models]—4. Sheet-metal materials—5. Machine types—6. Roller types—7. Standard parts—8. Roller materials—9. Order data—10. Target geometry—11. Strip widths—12. Profiling machine—13. Plan for stages—14. Check number of steps and stands—15. Tool calculation—16. General data I—17. Target geometry—18. General data II—19. Step geometry—20. Tool data

The technical expertise for profiling is contained in the problem modules (Figure 3). Based on the specification data in the order for a profile, the sheet width of the starting material is calculated. For this, a selection is made from among calculation instructions pursuant to DIN 6935, the Storoschew/Popow method,[7] Oehler's method,[8] and an in-house method. Subsequently, the user is offered the following capabilities:

- selection of a profiling machine from the machine file based on the profile data in hand or
- calculation of the most important profiling machine parameters and selection of the profiling machine from the machine file

The plan for stages, also referred to as "BLUME", contains the individual shaping steps from the flat sheet to the finished profile. BLUME is of critical significance for product quality and significantly affects product costs. The two aspects are interrelated and must be considered accordingly. The goal of the calibration specialist is to fabricate a profile of the requisite quality using the fewest possible profiling steps. If he uses too few steps, geometric deviations will appear in the profile and will subsequently have to be eliminated at increased expense during profiling tool design and manufacture. Here, the experience of a calibration specialist is very important.

For CAD profiling systems one significant task consists of assisting the profiling tool designer as early as the creation of the plan for stages. For this, it is important that the expertise of such a system be based on the experience of a calibration specialist and that this knowledge be expanded upon and improved by scientists.

It is only with such a foundation that users of such systems are willing to accept them. Based on these considerations, plans for stages, such as those applied in industry, were first evaluated along with the accumulated experience. Initial calculation proposals for standard profiles had already been successfully integrated into the PROMA version. In subsequent research, a new calculation model was developed for calculating the plans for stages of special profiles. Both the results mentioned and new test findings were merged in this model. Currently, it is possible for the computer to generate the plan for stages for a wide variety of profile

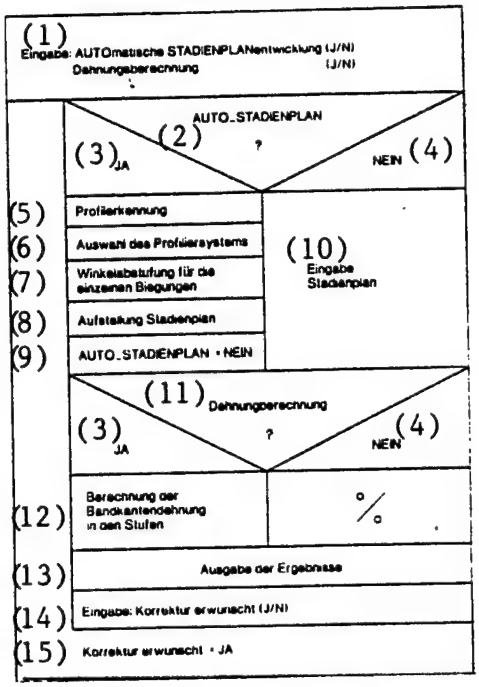

Figure 4. Structure chart of the creation of the plan for stages

Key: 1. Input: Automatic plan for development of the plan for stages (Y/N); Expansion calculation (Y/N)—2. Auto-plan for stages?—3. Yes—4. No—5. Profile identification—6. Selection of the profile system—7. Progression of angles for the individual bends—8. Set up plan for stages—9. Auto-plan for stages = NO—10. Input plan for stages—11. Expansion calculation?—12. Calculation of the strip edge expansion in the steps—13. Output of results—14. Input: Correction desired (Y/N)—15. Correction desired = YES

shapes. Using the program for stage plan creation, the profiling system (sequence of bends) is defined as a function of the geometric dimensions of the profile and the progression of the angles for the individual bends is adopted as a function of the material, among other parameters. With these data, the plan for stages is generated (Figure 4). In addition, it is possible to verify the magnitude and distribution of the strip edge expansion in the individual steps. The results of these calculations are displayed graphically and alphanumerically to the user. Thus he is in a position to decide in favor of adoption of the proposed plan of stages or to proceed to further corrections. [Figure 5 not reproduced]

Furthermore, with the program it is possible to adopt the plan for stages of a profile which has already been developed and to update it for a new profile. Building on the approved BLUME, the additional steps such as tool calculation, preparation for production, and manufacture of the profiling rolls can be carried out (Figure 2).

2. System Architecture of the Software Package

Continuing technical progress in the development and production of software and its increasing use in all areas of industry have led to higher demands for quality and acceptability of the software product to be developed. Essential points in the development of the software are

1. Designing a user interface which corresponds to the needs of the end user through
   - — integration of specific technical language and
   - — modern means of communication (e.g., mouse, graphic presentation, alphanumeric dialog).
2. Management of the data generated according to uniform principles with the following problem definitions:
   - — who needs which data, and
   - — how can they be stored efficiently?
3. Structure of a computer-internal data model (RIM)
   - — for modeling the profile data and tool data and
   - — for access to the calculation models on the RIM.

The following sections illustrate these points in detail in the context of the FLOWER system.

2.1 The Computer-Internal Data Model (RIM)

The RIM of the FLOWER system contains all data generated during a development period for one profile design. These data (e.g., plan for stages, tool dimensions, and machine data) can be generated by means of the dialog system or by means of the calculation model integrated into the system.

The following points constituted the starting point for development of a dynamic data model:

- Each profile consists of n steps (1:N ratio).
- For each step, m right and k left edges must be defined for the geometric description (1:N ratio).
- The profiling tools necessary for the shaping of one step are located on one stand (1:1 ratio).
- On each stand, profile rolls can be mounted on four shafts (main shafts and side shafts) (1:4 ratio).
- One roll set each can be mounted on each shaft (1:N ratio).

The entity relationship diagram shown in Fig. 6 can be derived from these fundamental considerations.

The integration of the RIM into the overall FLOWER system is depicted in Figure 7.

2.2 Data Management Concept

All the data manipulated in the FLOWER system contain multiple steps for the design and manufacture of profiling tools. The computer-internal data generated in the process can be differentiated into product definition data, whose basic significance is in the geometric aspect of the profiles, and in product presentation data, which are generated during a run cycle by the calculation modules present in FLOWER. In the following, all profiles described by the system are included in the

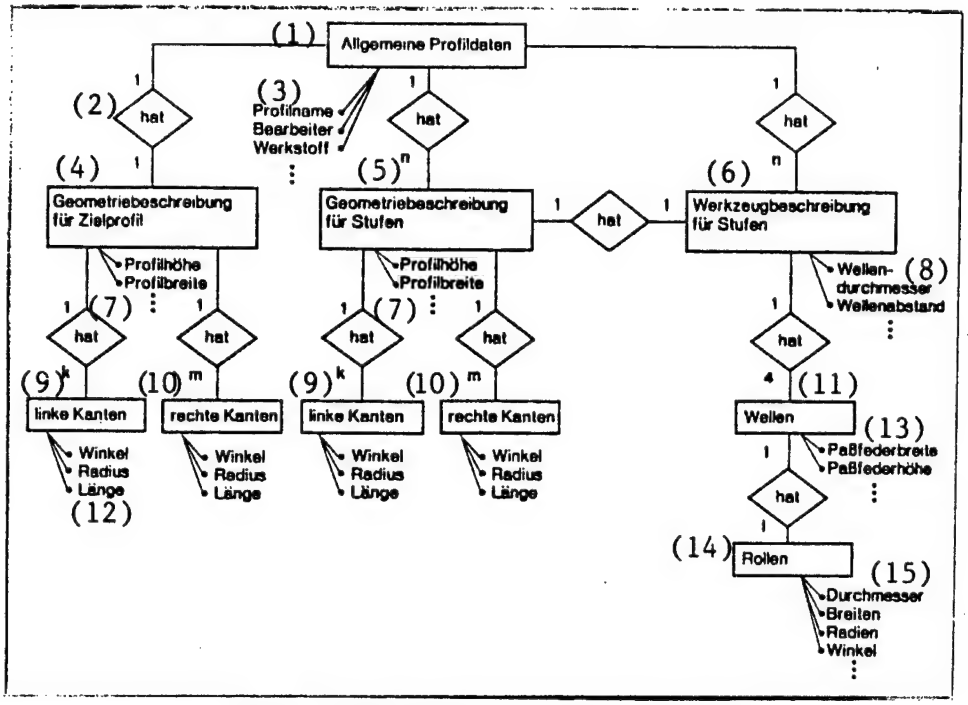

Figure 6. Simplified Entity Relationship Diagram

Key: 1. General profile data—2. has—3. Profile name, Developer, Material—4. Geometric description of the target profile—5. Geometric description for steps—6. Tool description for steps—7. Profile height, Profile width—8. Shaft diameter, Distance between shafts—9. Left edges—10. Right edges—11. Shafts—12. Angle, Radius, Length—13. Adjusting spring width, Adjusting spring height—14. Rollers—15. Diameters, Widths, Radii, Angles

comprehensive term "object." An object is defined as a data aggregate which describes a product.

In FLOWER there are two possibilities for managing objects as data aggregates on an external storage medium:

a. Each object is stored as a separate file:

Advantage:

An object can be quickly activated via an external access mechanism.

Disadvantages:

— The guarantee of consistency with regard to an access via the operating system is not assured.
— No global data searches through different profile data aggregates are possible without corresponding activation of the object.

b. Objects are stored in the archives. An archive is a file in which all objects are stored as data aggregates. Via a directory, referred to in the following as a "status file", logical access to the actual object for transfer to the RIM is possible.

Advantages:

— Using the status file, it is possible to select the objects to be activated according to logical aspects. Here, the consistency guarantee is always maintained.
— It is possible to search for profiles according to specific features (global characteristics).
— It is possible to set and alter development stages (designing a process model).

Disadvantage:

— Access to the actual data stock is delayed by the archive management mechanism.

Both access mechanisms are illustrated in Figure 7.

2.3 FLOWER's User Interface

The user interface of a software product generally represents the user communication relationship and user control of a system.

In FLOWER, communication takes place via text-based and menu-driven user interfaces. Graphic output supports the presentation of alphanumeric data.

The following communication components are offered within the system:

- horizontal and vertical menu control,

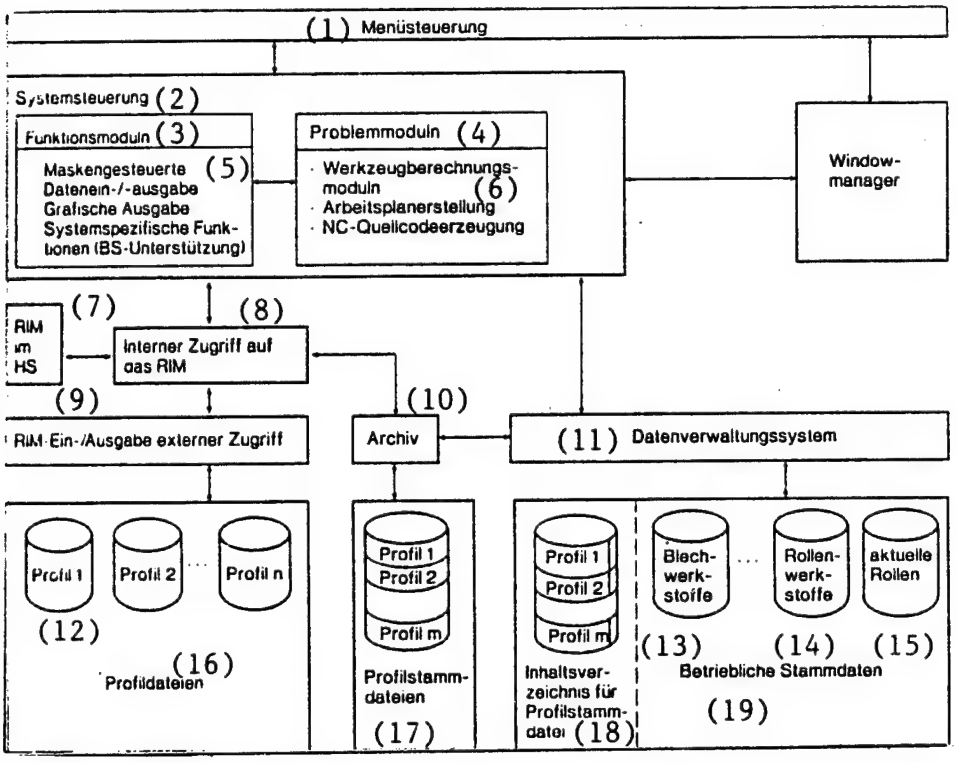

Figure 7. Simplified System Architecture

Key: 1. Menu control—2. System control—3. Function modules—4. Problem modules—5. Mask controlled data I/O, Graphic output, System-specific functions (BS support)—6. Tool calculation modules, Creation of operation plan, Generation of NC source code—7. RIM in HS—8. Internal access to the RIM—9. RIM I/O external access—10. Archives—11. Data management system—12. Profile—13. Sheet-metal material—14. Roller material—15. Current rolls—16. Profile files—17. Profile master files—18. Directory of the profile master files—19. Operational master data

- function key support based on the preset level of menu hierarchy,
- context-based integrated help system, and
- complex, mask-controlled alphanumeric data input with integrated data checking.

Numerous operations are made available through the menu system—all of which use interactive control to support the actual developmental objective, i.e., creation of tools. A limited excerpt from the menu system is shown in Figure 8. The menu item SYSTEM contains all system-specific control data required for the FLOWER system.

The menu item WERKZEUG (TOOL) is used to create a plan for stages related to its geometric description and the subsequent tool calculation.

The menu item TECHNOLOGIE implements the interface for production of the profile rolls. Here, the NC source codes for the profiling tools are to be generated as well as the operation plan master cards and parts lists necessary for technical preparation for production. The menu item ARCHIV includes the management of all profile data (objects) stored through the archiving functions.

The menu item DATENBASIS (DATABASE) is used for management and housekeeping of operational databases in which, for example, materials, standards, profile machines, and even previously calculated profiling tools can be stored.

3. Enhancements

In the archive, the completely developed profiles are stored with their data. Extensive knowledge and much experience of calibration specialists are stored in these data. This expertise can be called up via a similarity search for a specific profile and adopted and modified for a new profile. A second capability involves purposefully evaluating this expertise and integrating it together with research results and contributions from the technical literature of the field into a knowledge base. Work is currently in progress on this problem in order to offer a high level of technical support to the profiling tool design process with knowledge-based assistance in the program system.

The creation of a universal automated CAD/CAM system requires linkage of all steps from entry of the order to final production.

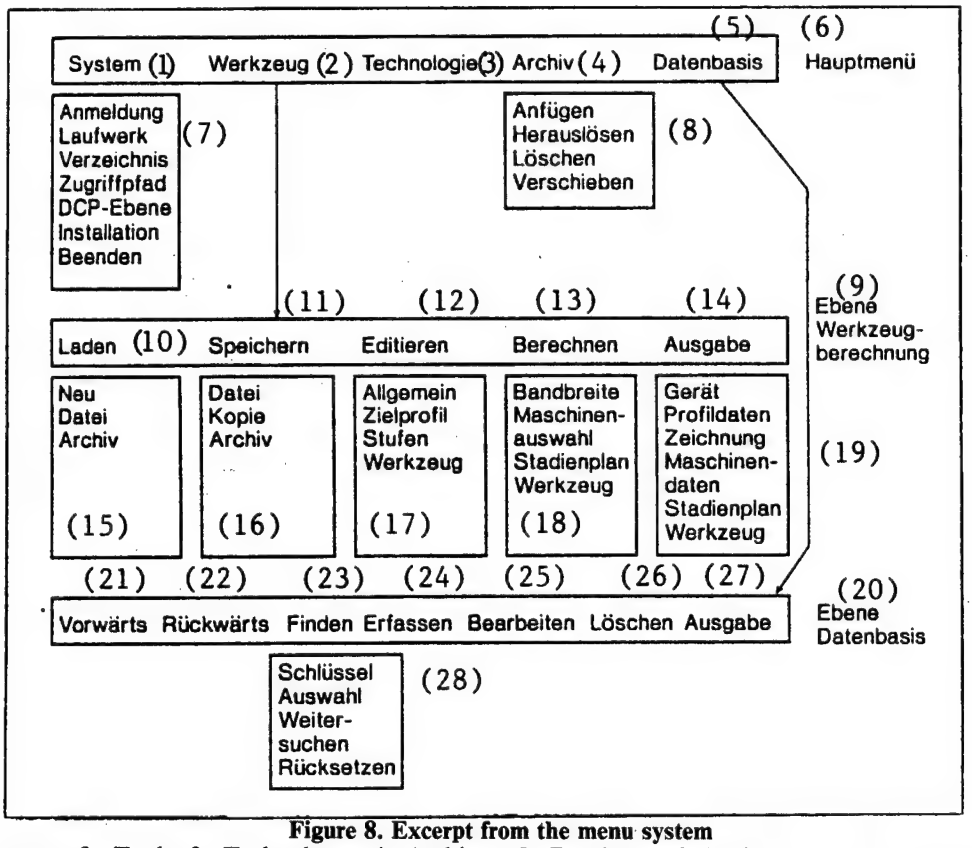

Figure 8. Excerpt from the menu system

Key: 1. System—2. Tool—3. Technology—4. Archive—5. Database—6. Main menu—7. Log-on, Disk drive, Directory, Access path, DCP-level, Installation, End—8. Append, search, Delete, Move—9. Tool calculation level—10. Load—11. Save—12. Edit—13. Calculate—14. Output—15. New, File, Archive—16. File, Copy, Archive—17. General, Target profile, Steps, Tool—18. Strip width, Machine selection, Plan of stages, Tool—19. Device, Profile data, Drawing, Machine data, Plan of stages, Tool—20. Database level—21. Forward—22. Back—23. Find—24. Acquire—25. Process—26. Delete—27. Output—28. Key, Select, Continue search, Reset

One important aspect of this is the direct linking of CAD-specific data (RIM) with the data necessary for the description format of an NC programming system. The advantages of direct adoption of data from the CAD system can be summarized in the following points[9]:

- guarantee of data and model consistency,
- minimization of errors, and
- faster job execution.

A few restrictions must be taken into account for the FLOWER system:

- All data for the geometric description of a roll to be produced are available via the RIM.
- Each roll can be categorized as a specific roll type (class).
- An NC macro is created for each roll type.

The CAD/NC linkage is therefore effected through the connection of the geometric data of the profiling tools (rolls) with the NC macro associated with the respective roll type. Thus, it becomes possible to describe all tools required for the production of a profile in NC technical terms.

The starting point for the development of the system was reduction of expenditures for the design and technical preparation for production in order to enable cost-effective production even of small lots of profiles. For determination of the price for the tool set for a profile or for a specific quantity of profiles, plans include enhancement of the system with a price calculation component. The user will thus be in a position to determine outlays, as well as price and profit, for a product immediately on completion of the design and technical preparation. The relevant program interfaces are in preparation.

4. Summary

It is becoming increasingly essential to use special CAD/CAM systems for the design and manufacture of profiling tools. Based on sound knowledge in the field of profiling acquired at the TU of Magdeburg, work is being carried out at this institution to implement this new

concept as a program system. This software concept was developed through interdisciplinary cooperation of metal forming engineers and computer scientists. The program system consists of modules for tool design and technical preparation for production. It supports the work of calibration specialists via a modern user interface, a variety of system-supported functions, and a specially developed database.

Using the system presented, it will be possible to design and generate relevant technical production documentation and NC data for a wide assortment of standard and special profile shapes. The dimensioning and design of profiling machines are also possible.

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LASERS, SENSORS, OPTICS

Germany: Filter for ESA Infrared Space Observatory Developed

90MI0345 Stuttgart LASER & OPTOELEKTRONIK in German Aug 90 p 17

[Text] The Institute of Microstructure Engineering at the Karlsruhe Nuclear Research Center (KfK) has now produced infrared filters for the photometer of the European Space Agency (ESA)'s Infrared Space Observatory (ISO). These filters are extremely thin copper membranes, just a few microns thick, with closer-set slit structures measuring as little as three microns. In 1993 the ISO is scheduled to observe infrared sources in space, such as the distant Milky Way, and also individual comets in the 3-200 micron wavelength range, while in orbit. This wavelength range of the infrared radiation emanating from space is not accessible from the earth's surface, as it is absorbed by the water vapor in the atmosphere. The ISO will be fitted with an infrared photometer (ISOPHOT) and other instruments to detect this cosmic radiation and measure its intensity in given wavelength ranges. For this purpose, the photometer must be equipped with interchangeable filters that admit these wavelength ranges selectively. These filters consist of copper membranes that are mounted on 15-mm diameter diaphragm rings and have characteristic slit structures that determine their transparency. The thickness of the membranes and the characteristic dimensions of the slits must be commensurate with the wavelength to which they are transparent. The quality of the filter, i.e., its transparency and selectivity for a given wavelength range, depends on the exact shape, usually a cross or a three-pointed star, and dimensions of the slit structure, and also on its reproducibility and precision. These microstructures that provide the highest precision in the smallest dimensions are produced by the KfK using the LIGA process that it has developed itself. An electron-beam writer is used to produce a mask that transfers the structure of the end product as a negative into radiation-sensitive plastic layer. The radiated parts of this layer are chemically dissolved and then galvanically filled with copper. A high degree of plane parallelism among the peripheries of the slit structures is achieved with synchroton beam exposure. The structured copper membranes of about 15 mm diameter thus created are then mounted on a copper diaphragm ring in a further complicated manufacturing process, another masterpiece of engineering, as the thinnest membranes are only two-thousandths of a millimeter thick. Altogether 40 of these filters have been produced for the space observatory.

METALLURGICAL INDUSTRIES

France: High-Precision Metal Casting Process Developed

91P60024A Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 8 Oct 90 p 10

[Text] The French firm Societe Nouvelle GHM claims that, by using a special technique, it can manufacture cast steel and iron parts with heretofore unattainable precision. The new technique makes use of new molding equipment bearing the designation GF Impact Turbo Plus and permits good dimensional stability during cooling. In this technique, the surface of the green molding sand in the molds is set into place under pressure by intermittently decreasing the pressure of highly compressed air. The resultant shock wave compresses the molding sand and imparts to it an otherwise unattainable strength.

After this pretreatment, the molding sand is better able to withstand mechanical forces during the casting process as well as the graphite expansion phase during cooling. This results in dimensionally precise cast items with a high repetitive accuracy made even higher by the automatic Metzger casting process. Here, all motions during the initial casting process are recorded so that they can be subsequently called up and repeated as often as need be. Thus, all critical parameters, from the duration of the casting process to the quantity of metal cast to the instantaneous flow rate can be perfectly reproduced. The Societe Nouvelle GHM stresses the fact that the continuous monitoring of each cast item, from the smelting stage onward, is an important quality assurance criterion. Even prior to the removal of items from the molds, spectrographic analysis is performed so as to detect possible metallurgical imperfections.

The casting operations make use of molds measuring 1250 mm x 900 mm x 300 mm. Using this new technique, up to 130 cast items can be manufactured per hour. On a monthly basis, the Societe Nouvelle GHM itself processses 1000 tons of cast iron with lamellar graphite and 400 tons of casting steel or specialty molten metals. The mold sizes make it possible to manufacture large-sized cast parts for commercial vehicles, e.g., engine blocks and gearing assemblies; but, smaller cast parts such as camshafts, brake disks, flywheels and exhaust manifolds can also be manufactured using this process.

MICROELECTRONICS

German University Awarded Semiconductor Crystal Project

91MI0017 Bonn TECHNOLOGIE-NACHRICHTEN MANAGEMENT-INFORMATIONEN in German 26 Sep 90 pp 11-12

[Text] An interdepartmental project at Erlangen-Nuernberg University, which is funded by the Volkswagen Foundation with DM1.9 million grant, aims to achieve a fundamental improvement in the production of semiconductor crystals. The departments of material sciences VI (Prof. G. Meller, who is also the project leader), fluid mechanics (Prof. F. Durst and Dr. M. Peric), and computer architecture and traffic theory (Prof. U. Herzog, Dr. W. Erhard, Dr. K. D. Reinartz) are participating in the project.

Semiconductor crystals are the basic material for electronic components, for example, electronic circuits ("chips"), without which all our helpful computers could not operate. In most cases these crystals consist of silicon or, in special cases, chemical compounds like gallium arsenide or indium phosphide. Crystal production is labor-intensive and expensive, owing largely to the very high proportion of waste due to the fact that only flawless crystals can be used for electronic circuits. Better results could be achieved if, first and foremost, the flow processes that take place during semiconductor crystal growth were brought under control. It is now possible to simulate these processes on computers. To date, however, it would be asking too much even of the biggest computers to simulate growth processes, so several computers have to work on solving a problem at the same time. To cope with all this, materials scientists (crystal growers), flow researchers, and computer scientists at Erlangen University have joined forces. The Volkswagen Foundation is subsidizing the project as part of its "Interdisciplinary Joint Projects in Engineering Sciences" program, set up for the specific purpose of fostering cooperation between different disciplines.

Producing semiconductor crystals involves melting silicon (or gallium arsenide phosphide) in a crucible at temperatures of more than 1000°C and solidifying it gradually on an immersed, cooled, seed crystal. Rotating the seed crystal while drawing it upward will cause the entire melt to "crystallize out" as a cylindrical crystal. This prevents the emerging crystal from touching the crucible, which would cause faults in the material and render it useless.

Future microchips will require larger crystals (for example, 2 m long and 200 cm [as published] in diameter). Their quality is determined essentially by flow processes in the crucible. These flow processes are caused firstly by differences in temperature leading to buoyancy, secondly by the rotation of the crystal, and finally by processes on the surface of the melt. Normally this causes complicated, turbulent flow processes that are very difficult to control in the industrial crystal manufacturing process.

This is where the Erlangen project comes in. Computer calculations will ascertain the most favorable conditions for the apparatus, such as temperature distribution, available size and shape, heater design, external magnetic field, and gas transport across the melt. This project is the first time that material scientists are working together with fluid mechanics experts and computer scientists. Their joint work will transpose the computerized flow process calculation know-how acquired in aeronautical and mechanical engineering to the materials science-related problem in hand. However, owing to the complexity of the flow processes (tridimensional, time-dependent, even turbulent flows with complex marginal values) not even the biggest computers currently available can handle the enormous numbers of computing operations and data required. Computer architectures, program structures, and computing processes capable of simulating the crystal growth process at reasonable speed must therefore be sought and tested with the help of computer scientists. In this connection, concepts of parallel processing involving several processors (computers) simultaneously work on solving the same problem are being examined. These "parallel computer structures," as they are called, are designed for enhanced capacity and computing speed. The ultimate goal is to arrive at a concept of how computer simulations of semiconductor crystal growth can be efficiently

handled. This concept will then be used to design industrial equipment accordingly and to organize the process in such a way as to obtain the required crystal quality.

Additional information may be obtained from Prof. G. Mueller, University of Erlangen-Nuernberg Institute of Material Sciences VI, Marienstr. 7, 8520 Erlangen, Tel. 09131/85-7636.

Jessi Italia Consortium Established

90MI0342 Milan ITALIA OGGI in Italian 11 Sep 90 p 35

[Text] The partial withdrawal of Philips from JESSI [Joint European Submicron Silicon Initiative], the European research project on semiconductors, is "an accident along the way," a "slight shadow" for a program that maintains all its vitality. This was evidenced by the formation of the JESSI Italia consortium, officially established yesterday in Milan at the headquarters of SGS-Thomson [ST] of Agrate in the presence of Minister of Research Antonio Ruberti and the managing director of Finmeccanica, Fabiano Fabiani, with the signature of universities, private companies, and state research organizations (CNR [National Research Council] and ENEA [Italian Committee for Research and Development of Nuclear and Alternative Energies]). It was also demonstrated by the interest in participating in JESSI shown not only by IBM, which already has a foot in the door, but also by other American firms such as Motorola and DEC hopefully waiting on the threshold. This is what JESSI's European president, Raimondo Paletto, who is also the managing director of SGS-Thomson, wanted to emphasize. The Philips legacy in static memories (SRAM) will be divided between Siemens and ST for the essential base technologies "only if the respective governments make provisions to contribute the financing," noted Paletto. The development of the product, if it is carried forward (JESSI's board of directors will decide), would logically be the province of ST, which is already active in static memories.

It Is Important To Develop New Specialists and Technicians

"JESSI Italia, which aims to promote research and training initiatives in microelectronics by encouraging collaboration between private enterprise, universities, and centers of research, is studies with much interest by France and Germany as a formula. There is already a JESSI France, limited to research on developing equipment", explained Paletto.

Ruberti, visibly satisfied, went further. "JESSI is the first true European initiative in high technology close to the market. We hope that it achieves the same results of the only comparable initiatives, CERN [European Center for Nuclear Research] of Geneva for particle physics and JET [Joint European Torus] for nuclear fusion. And we also hope that JESSI Italia helps the Italians to have as important a role as they have in physics and fusion," he said with a crafty smile. The minister has already requested—"despite the well-known problems of public financing"—an allotment of 80-100 billion lire per year to be included in the budget for the Italian consortium. This sum would be added to the Italian government's anticipated contribution to JESSI.

Participating in the consortium at the principal universities (the two in Rome, those in Bologna, Pavia, Pisa, Naples, and the Polytechnical of Milan and Torino), public research organizations (CNR and ENEA), and both electronic and non-electronic private companies (Elsag, Centro Ricerche Fiat, IBM Italia, LPE, Marelli Autronica, Mazzali MEMC, Robotica, Selenia, SGS-Thomson and Telettra). The companies together with ENEA will create a consortium fund of 500 million lire, while the universities and the CNR will provide scientific and operational contributions. "The consortium formula should help in the preparation of basic research initiatives in microelectronics common to enterprises and universities, for which the Italian structures are not well-equipped, and simplify the organizational problems of relations with the European research programs," added Ruberti.

To date JESSI's budget (which forecasts investments of 6 trillion lire) covers approximately 200 proposed projects, 53 approved, chosen according to the strategic interest in European systems capacity—not only for the development of components—and rejecting the logic of overfinancing those initiatives born to "resolve the production problems of small and medium-sized firms," added Paletto. The positive research results have allowed the date forecast for the debut of the 16 megabit DRAM [dynamic random access memory] memories to be moved forward from 1996 to 1994.

Philips apart, there is also the problem of the English firm ICL, 80 percent of which was acquired by the Japanese firm Fujitsu. ICL is participating in five JESSI applications projects (therefore distant from the basic technologies, to which, however, it would have access). "We are asking ICL's partners if they have problems cooperating with the new Japanese owners" Paletto explained, "we are far from considering expulsion." On the other hand, negotiations with Sematech, the American chip research consortium, are proceeding well. Reciprocity, that is, the opening of Sematech to European firms, is the prerequisite for the participation of American firms in JESSI. First among these is IBM, which already has had a project approved (with this reservation) on photolithography (the new chip printing technology in which the multinational is very advanced).

Belgian Company Upgrades BiCMOS Technology

90AN0377 Paris ELECTRONIQUE HEBDO in French 7 Jun 90 p 15

[Article signed F.G.: "Second Factory in Sight for Mietec!"]

[Text] According to M.J.P. Liebault, manager of Mietec [Microelectronics Technology]-Alcatel (the company

was renamed after its 100-percent takeover by Alcatel), the year 1990 finally appears in a much more favorable light than expected. The company, whose 1989 sales amounted to more than $52 million with over 100,000 silicon wafers produced, anticipates a growth rate of approximately 30 percent this year (20 percent expected initially) and a production of about 160,000 wafers. This production should induce it to contemplate a relatively early extension of its production unit at Oudenaarde. In fact, the present factory has a maximum production capacity of 180,000 4-inch wafers per year, a limit that should soon be reached. The future unit, to be located on the same site, should be equipped for 150-mm wafers suited for submicron technologies.

Low-Pass Filter in 40-Volt BiCMOS

Mietec-Alcatel, which remains the first European manufacturer of application-specific integrated circuits in BiCMOS (bipolar complementary metal-oxide semiconductor) technology, has just upgraded its 40-volt BiCMOS technology by introducing high-performance cells and a mixed analog-digital simulator including a switched-capacitor filter compiler. Thanks to this compiler and to the so-called Turbo-cells, an application-specific circuit designer will be able to combine a switched-capacitor filter, a band-gap voltage reference, and a bipolar output layer on a single chip. It could already be done in complementary metal oxide semiconductor (CMOS) technology, but at the expense of a loss of performance. Generation of these Turbo cells involves, on the one hand, a low-noise operational amplifier combining a high input impedance, a low thermal noise level (8 nanovolts/square root Hz), and a 100-Hz open-loop cutoff frequency and, on the other, a high-impedance broadband amplifier (15 megahertz gain-bandwidth product, capacitive load ranging from 0 to 20 picofarads). With these new cells and the filter compiler, Mietec-Alcatel has developed a fourth-generation low-pass filter in 40-volt BiCMOS technology. This filter has a typical sampling frequency of 64 kHz, a cutoff frequency of 3.4 kHz, a passband ripple of 0.05 decibel, and a rejection rate of more than 42 decibels in blocked-band mode.

An identical filter is being developed with a 15-megahertz operational amplifier. Its maximum sampling frequency will be 10 megahertz, and the passband of the signals processed will be greater than 500 kilohertz.

Besides this 40-volt BiCMOS technology, Mietec-Alcatel is developing an 80-volt BiCMOS technology as well as a medium-voltage hybrid technology (12-volt BiCMOS). With these technologies, the company is mainly targeting the smart-interface market, applications requiring voltages ranging between 10 and several hundreds of volts and currents of 100 milliamperes to several amperes. Mietec-Alcatel should also put 1.2-micron CMOS technology into production before the end of the year, 0.8-micron technology still being in process of development.

Next-Generation Transputer Described

90AN0419 Edam SUPERCOMPUTER EUROPEAN WATCH in English Jul-Aug 90 pp 8-9

[Article by Ian Pearson, technical director of Inmos, Ltd: "The Life of the T-Range Will Be Extended by the H-Range"]

[Text] Since the T414 and T212 were launched in 1985 the transputer family has evolved: In 1987 the T800, the floating-point transputer was introduced. This was followed by upgrades including devices with more internal memory, and higher clock speeds, with 30 MHz parts now available.

Pearson admits that there has been an evolution of the basic machine since 1985, but "much of our investment has gone into software and support products, we do not only put our money into Silicon." Clearly that is a wise move for any microprocessor manufacturer, not only for the current range of products but also for the future, and Pearson adds "a solid base of quality software is essential for the longevity of the present transputer, and also for the generation of transputers that follow."

In the past few years Inmos has been under pressure to produce a number of transputer variants. Unfortunately this demand has come from companies which required only relatively small volumes. Inmos has therefore taken the initiative to move the existing transputer components into ASICs (application-specific integrated circuits), a "hardware library" to meet such diverse demands. The T800, for example, was designed as a number of silicon modules, including RAM, CPU, FPU, the communication subsystem, which were then integrated on a single chip. By making these modules available separately, customers can add the hardware functions they require from available ASIC libraries, for instance standard interfaces or extra on-chip memory. Pearson remarks "this is not a trivial process, it is not just a processor broken up in blocks and put it into LSI logic. You must also have all the support tools in place and we are currently producing those. We will move the future transputer product to ASIC as well."

Inmos believes you cannot pursue a micro-processor strategy properly unless you take new products from first specification to market in a 18-24 months period. The design of the next generation transputer, the H1, is complete, and "we are already specifying the H2." "H1" is the code name for the next generation transputer—"there will be a prize for those that can help us to think up a name, when we launch it." It is the first member of a new family of transputers targeted at the high-end embedded system market with derivatives (H2, H3, etc.) finely targeted at particular applications.

H1 features improved performance (peaks of 150 Mips and 20 Mflop/s) "combined with continued ease of use." This will be achieved by:

- Pipelined, superscalar micro-architecture: ability to execute up to eight instructions in one clock cycle.

- On-chip scalar redesigned FPU, operating currently with ALU.
- On-chip instruction and data cache: 16 Kbytes, switchable to on-chip memory, so one can control the combination of RAM and cache.
- Workspace cache, this means fast access to local variables.
- Support for 4 banks mixed memory systems; up to 16 Mbytes of DRAM can be attached with no external logic.
- Instruction cycle count is reduction; most instructions cost now 1-2 cycles.
- Enhanced support for debugging, for as Pearson admitted "we have been beaten around our ears for our lack of debugging."

Additional support for inter-processor communications includes:

- New high bandwidth links: 80 Mbytes/s total bi-directional bandwidth for 4 links.
- New link protocol to support high bandwidth links; Pearson would not say how high.
- On-chip virtual channel processor, this allows multiplexing logical channels onto physical links.
- Off-chip message routing: supported by low latency, high bandwidth, dynamic routing switch.

The H-range will supplement and not replace the present range of transputers. As Pearson puts it "the H-range is the start of the T-range really." Be that as it may, there will be support for mixed Tx/Hx systems in the form of binary compatibility and chips for converting and link adaption.

NUCLEAR ENGINEERING

EC To Boost Thermonuclear Fusion R&D

91AN0026 Brussels EUROPE in English 28 Sep 90 p 8

[Article: "(EU) Research: The European Commission Proposes to the Council a Programme on Controlled Thermonuclear Fusion, a Change in JET and the Continuation of the International ITER Project"]

[Text] Brussels, 27 September 1990—The European Commission has adopted three proposals to the Council in the area of thermonuclear fusion, on the initiative of Vice-President Pandolfi, namely:

1. A specific R&D programme in the area of controlled thermonuclear fusion (1990-1994). This proposal is the fifteenth and last one aimed at implementing the Third Research & Development Framework Programme 1990-1994.

2. The change in the statutes of the Joint venture JET (Joint European Torus) so as to extend the project up to 1996.

3. A negotiation directive for continuing cooperation between the EC, Japan, the United States and the USSR concerning the project for an International Thermonuclear Experimental Reactor (ITER).

The long-term objective of the Community action underway for many years in the area of thermonuclear fusion is the realization in the middle of the next century of prototype reactors that are "safe and not harmful to the environment." The three new proposals are related. A strategy in stages is being contemplated to attain the objetive of commercial operation. The first stage, corresponding to the research currently being conducted by JET, consists of providing evidence of the scientific feasibility of fusion. The second stage (called the "next step") provides for the construction of an experimental reactor. Finally, the third stage will comprise the realization of a demonstration reactor, "DEMO."

The priority of the new specific fusion programme is the establishment of the scientific and technical basis for the construction of an experimental fusion reactor (next step) and the preparation of industry. The extension of JET to 1996 should allow support to be provided for the research activities of the second stage. The experimental reactor should allow self-maintained and long duration fusion reactions to be produced.

EUROPE reminds readers that overall Community financing in this area totals ECU 458 million to the end of 1994.

EC Adopts Nuclear Fission Program

90AN0408 Brussels EC INFORMATION MEMO in English No P-56, 1 Aug 90 p 1

[Article: "Research Programme In The Field of Nuclear Fission (1990-1994)"]

[Text] Acting on a proposal from Vice-President Filippo Maria Pandolfi, the Commission has adopted a proposal for a specific research and technological development project for the European Atomic Energy Community in the field of nuclear fission safety.

This programme joins the thirteen other specific programme proposals adopted by the Commission on 25 April 1990, aimed at implementing the third Community Framework Programme of Research and Technological Development (1990-1994).

Two aspects of nuclear fission safety are covered in the programme: radiation protection and reactor safety.

Exposure to radiation is likely to have severe consequences on the health and genetic constitution of humans (for example, cancer and congenital malformations). The objective of the programme is to use effective research activity to further knowledge of the effects and risks associated with radiation exposure, in particular those resulting from low radiation doses, in order to permit the elaboration of suitable common safety standards and rules.

The extent of the consequences of the Chernobyl disaster is a reminder of the importance which must be attached to the safety of nuclear power stations. In this respect, research activities will focus on the safety of radioactivity confinement in the event of a nuclear accident. More specifically, they will concentrate on the study of the various stages of development of a nuclear accident, the quality and performance of confinement systems, human error in such a situation and the most effective way of correcting it.

The total financial package allocated to the programme is ECU 199 million over a period of five years (1990-1994). The programme will be carried out by means of shared-cost research projects, direct research activities undertaken by the Joint Research Centre (JRC), concerted actions and accompanying measures (dissemination of results, training, etc.). The research undertaken by the JRC will be the subject of a separate Council decision.

SUPERCONDUCTIVITY

Italy: Research Center's Superconductivity Studies Reported

90MI0361 Milan CISE NEWSLETTER in Italian Jul 90 pp 1-2

[Excerpts][passage omitted]

CISE's [Center for Data, Studies, and Experimentation] superconductivity studies are carried out in the Physics Technology Department under Dr. Antonio Ricca. Activities began in 1974 in collaboration with ENEL [National Electric Power Company] when a laboratory was set up to evaluate the possible applications of superconductors in the transport of electrical energy and in the development of an innovative alternator. Subsequently, the behavior of superconducting composites in magnetic transistors was studied in collaboration with ENEA [Italian Committee for the Research and Development of Nuclear and Alternative Energies]. These superconducting composites will be used to construct the toroidal magnet of the soon to be developed NET [Next European Torus] machine designed for the study of thermonuclear fusion.

Immediately after the discovery of high critical temperature ceramic superconductors (HTSC), ENEL showed a great deal of interest in this pioneer technology and commissioned CISE to carry out research and development in the field. CISE's current goal is to produce HTSCs with a high level of critical current and magnetization, with the prospect of applications in the energy sector. For this reason, superconductor products such as bars, ribbons, etc. are being prepared and studied by using innovative techniques such as fusion and directional solidification and lasers for ceramic coatings on silver ribbons as well as conventional solid state reaction techniques.

The study of materials aims at developing production techniques that are capable of orienting the grains of the structure and increasing their electrical coupling capability, which improves their electrical and magnetic properties as well as structural characteristics. The equipment CISE currently has at its disposal for the characterization of superconducting materials is the only one of its kind in Italy and one of the few in Europe (see table).

The skills that CISE has developed and its existing equipment allow for the complete electrical and magnetic characterization of superconductors. In particular, CISE can carry out measurements of:

- critical current in the presence of a magnetic field up to 12 T;
- critical temperature using a four wire resistivity method;
- magnetization and magnetic susceptibility;
- power dispersed in superconductor wires exposed to a variable magnetic field, or in the presence of AC transport current.

In addition to investigating the mechanisms of energy loss, magnetic measurements permit the density of critical current and the quality of the superconducting ceramic material to be evaluated.

Demonstration models of the inductive limit of currents and of magnetic levitation bearings have also been developed by exploiting the properties of HTSCs. [passage omitted]

CISE Instruments for the Characterization and Preparation of Superconducting Materials

SQUID Magnetometer (Superconducting Quantum Interference Device) with a high resolution (10^{-8}emu); measurement margin: +/- 300 emu; temperature range: 1.8 - 800K; magnetic field range +/- 5.5T

Computerized system to measure the magnetization of superconductor samples exposed to variable magnetic fields (B^*_{max} = 0.3 T/sec), based on a highly sensitive integrating magnetometer operating between 1 mHz and 100 Hz developed by CISE. [* - magnetic vectorial field]

Gaseous helium flow calorimeter to measure power dispersed in superconductor wires when an alternating current between 1 Hz and 5kHz passes through, based on a compensation microwattmeter developed by CISE.

Closed circuit refrigerator to measure four wire resistivity at a temperature between 10 and 300 K.

Eight T Cryostat with solenoidal magnet (L = 2.4 henry, D_{int} = 50 mm) and relative power source (12 V, 120 A) for measurements in variable magnetic fields

12 T cryostat with magnet to measure critical current J_c (up to 500 A)

Power supplies: 50 Hz, I_{max} = 2000 C; 20 Hz-600 Hz, I_{max} = 500 A; 0-5kHz, 100 V, 20 A

Equipment to prepare new superconducting ceramic materials on a laboratory scale: kilns, mills, presses, lasers for ceramic coating, etc.

TECHNOLOGY TRANSFER

Germany, USSR Develop Lasers for Medical Applications

90MI0352 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German No 34, 22 Aug 90 p 7

[Text] Soviet and German scientists intend to undertake joint research into new laser light sources, such as solid-state lasers, that operate with holmium and erbium atoms. Under the agreement on scientific and technical cooperation that the governments of the FRG and the Soviet Union signed in 1986, scientist from the Institute of General Physics at the Academy of Sciences in Moscow and the Berlin Laser Medicine Center are working together on application-oriented basic research. The researchers are seeking laser light whose beams are better suited to certain types of tissue. They will thus attempt to develop fibers suitable for ultraviolet and infrared light for use in laser endoscopy and improved diagnostic methods that will make it possible to detect tumors more rapidly. The Federal Ministry of Research and Technology (BMFT) has allocated DM500,000 to finance this work through 1993.

TELECOMMUNICATIONS R&D

RACE: Integrated Broadband Communications Testing Project

90AN0402X Brussels THE SPAG STANDARD in English Summer 90 p 4

[Article: "RACE Project Number R1087"]

[Text] This issue of THE SPAG STANDARD moves away from the CIM environment covered by the last two issues and takes a look at another EC initiative this time in the telecoms industry, in particular in the field of IBCN (Integrated Broadband Communications Network) environment.

The RACE Is On—PROVE-ing Ground for IBC

SPAG's (Standards Promotion Application Group) connection is through a specialised project within the EC programme RACE (R&D in Advanced Communications Technologies in Europe). The project in question is called PROVE (PROvision of VErification) and is concerned with IBC verification and testing methodology and tools.

PROVE builds upon the success of a previous RACE project—RSVP (RACE Strategy for Verification and Plan)—executed by a consortium of PTTs and representatives from both industry and users with SPAG acting as prime contractor during 1988.

Members of the PROVE consortium are: SPAG (prime contractor, Belgium); British Telecom (UK); Deutsche Bundespost Telekom (FRG); France Telecom (France); EOLAS Irish Science & Technology Agency (Ireland); Televerket (Sweden); Standard Elektrik Lorenz/Alcatel (FRG); Cap Sesa Region (France); Clemessy (France); Elektronik Centralen (Denmark); Hasler (Switzerland); Refer (Belgium); and NCC (UK) providing additional consultancy support.

PROVE is already over 18 months into its four-year working period (1989-1992). Following a successful 1989 audit, the RACE Central Office gave the consortium the go-ahead to initiate Verification Tool Development.

The total budget amounts to ECU 13.6 million. The CEC will contribute up to 50 percent of the budget, i.e., ECU 6.8 million. SPAG's nominal contribution is for 95 man months over four years with a net cost of ECU 816,000, of which ECU 220,000 were earmarked for the first year.

Project Objectives

- Concepts and Procedures:

Take a leading role to establish consensus on ISDN-BB (broadband) verification concepts, requirements and procedures (3 years).

- Interoperability Testing (IOP):

Establish methods and procedures for interoperability testing in ISDN-BB environment (4 years).

- Computer Aided Test Case Generation (CATG):

Define a methodology and recommendation for CATG (2 years). The study may result in prototype development depending on the results of the 1990 audit evaluation (over 2 years).

- Verification Tools:

Development of prototypes for the following verification tools (4 years):

— System access interface

— Call generator for load simulation

— Signalling control unit

Links with Standardisation Bodies

PROVE deliverables are providing the bridge between the work undertaken in RACE and the standardisation activities of both ETSI (European Telecommunications Standards Institute) and CCITT (Consultative Committee for International Telephone and Telegraph).

As far as Computer Aided Test Case Generation deliverables are concerned these are useful for both CCITT Study Group X (involved in Formal Description Techniques, Man-Machine Language and CHILL [CCITT High Level Language]), and ETSI's Advanced Test Methodology expert group as they provide essential working documents for further elaboration by these two standards groups. Deliverables from the consortium in the domain of IOP have, for example, triggered off the creation of a new working group in ETSI (ATM2) in 1991.

Thomson Receives HDTV Grant

90AN0386X Antwerp DE FINANCIEEL-EKONOMISCHE TIJD in Dutch 24 Jul 90 p 14

[Text] Paris (AFP)—The French Government is granting the French electronics giant, Thomson, 3 billion francs (Fr) spread over a five-year period for research into and development of high-definition television (HDTV). In addition, Thomson will receive a capital contribution amounting to Fr2 billion. This was announced by the French Ministry of Industry last Monday. Thomson itself has already earmarked Fr6 billion for HDTV. The other partner in the project, Philips, must come up with Fr11 billion. In the agreement with the French Government, Thomson committed itself to the execution of a well-defined research program and to strict deadlines for the development and marketing of HDTV products. Prototypes of HD-MAC television sets should be ready for use at the 1992 Olympic Games in Albertville. HD-MAC is the European standard for HDTV.

Next Tuesday night, the European Ariane rocket will launch the second French satellite for direct broadcast TV, TDF-2, as well as the German telecommunications satellite Kopernikus 2. The French grant to Thomson was the very last support European industry could expect in its competitive struggle with the Japanese HDTV standard and in support of its own D2-MAC standard (transition standard between the actual HDTV and HD-MAC). The consequences of Philips' reorganization efforts are still unclear, but the management repeatedly promised that the HDTV research program would not be jeopardized.

Italian Company's HDTV Research Activities Reported

91MI0028 Milan SISTEMI DI TELECOMUNICAZIONI in Italian Sep 90 pp 102, 104

[Text] Telettra began to carry out research in the field of conventional television signal transmission using the numerical technique in 1985.

Successively it launched studies which in 1989 led to the development of CODEC, the numerical transmission system for high definition television (HDTV) signals.

CODEC Telettra, due to a particular coding of the signal, allows for long-distance transmission, as for example in the case of the Olympus satellite which orbits at a distance of 36,000 km from Earth. The system is currently the most advanced in the world in this field of application.

The characteristic feature of high definition television is the quality of the image—comparable to the best cinematographic images—and the sound, which is similar to that reproduced by a compact disc. As an example, the conventional television image is composed of 625 horizontal lines while the projects for high definition TV provide for a doubling of the lines. Even the proportions of the screen will change, passing from a traditional "square" (4:3) to a more rectangular (16:9) shape similar to that used in cinematography.

Another fundamental characteristic of high definition is that the spectator can "live" the sensation of taking part in the scene. Given the quality of the image it is possible to get closer to the screen, thus being able to use a vision angle of 30° as opposed to the normal 10° for conventional television.

The project leading to CODEC's development is part of the EUREKA [European Research Coordination Agency] EU-256 program which, in addition to Telettra, includes RAI [Italian Radio Broadcasting and Television Company], Retevision Spagnola, and the Polytechnic of Madrid.

CODEC Telettra is capable of operating with the Japanese and European HDTV standards (1,125 lines, 60 Herz and 1,250 lines, 50 Herz respectively). The possibility of using CODEC Telettra for the two production standards shows the operating flexibility of this solution which was adopted in the context of worldwide television production.

The principle problem that Telettra solved—and that had always been a major stumbling block for designers worldwide—was the need to compress the high definition signal (at the source equal to more than a billion bits per second, corresponding to about 15,000 telephone channels transmitted by a numerical system) to permit its subsequent transmission to present-day carriers (satellites, optical fibers, etc.) at an acceptable cost. Telettra's technology, which is based on the DCT (Discrete Cosine Transform) algorithm, created a compression

ratio of about 15 times, reducing the information transmitted to 70 million bits per second, without any reduction in quality detectable by the human eye.

The achievement of these prestigious results is proof of the technological capability and active collaboration that public and private concerns in Italy and Spain have demonstrated in a sector of great technological dynamism and turbulence such as the telecommunications sector.

The experiment currently under way at the World Cup Soccer Championships involves the first international link-up using numerical technology. The signal is sent by the television cameras to CODEC Telettra's transmitting element and then to the Olympus satellite on channel 24. The spectators present in the seven viewing centers in Italy—such as Lingotto in Turin—can watch the soccer matches with a system that consists of an antenna to receive the satellite's signal, CODEC Telettra's receiving element, and a large 120-inch television screen.

Likewise in Spain the signal is received in Barcelona from the Olympus satellite and from there sent via optical fibers to Madrid.

Only professional uses (of the point-to-point type) are currently foreseen for CODEC Telettra. These include, for example, connections between television studios, telemedicine, the long-distance transmission of "computer graphic" images, industrial applications, high quality video-conferences and more. All of these applications are already being requested by the Japanese and American markets and their eventual extension to Europe is expected.

CODEC Telettra is part of a project that is not intended to be an alternative to the HD-MAC system for the direct diffusion of high definition to the consumer using analogical technology. The latter is part of the EUREKA EU-95 program, with the participation of an Italian consortium which also includes RAI and Telettra. The HD-MAC system will be tested at the same time as the EU-256 system and received in Milan and Central Europe on channel 20 of the Olympus satellite.

BIOTECHNOLOGY

Hungary: Godollo Agricultural Biotechnology Center

91WS0011A Budapest MERES ES AUTOMATIKA in Hungarian No 4, Jul-Aug 90 p 217

[Article by Janos Goz: "Seniors' Visit to the Godollo Agricultural Biotechnology Center"]

[Text] Seniors from the Measurement Technology and Automation Scientific Association and sister associations visited the Agricultural and Biotechnology Research Center in Godollo. The 29 members were received by Dr. Ervin Balazs, chief director, and Dr. Janos Pek, the managing director entrusted with institute investment. Dr. Zsigmond, the secretary, guided the visit. They gave a briefing on the circumstances of creating the institute and about its organization and tasks. We thus learned that in 1984, with a decision by the Ministry of Agriculture and Food and with the support of the MTA [Hungarian Academy of Sciences] and the OMFB [National Technical Development Committee], the Ybl Prize winning architect Lajos Zalavary was commissioned to design an institute to be built in Godollo which would supplement the work of the Biological Institute in Szeged. On the basis of a competitive bid the Philipp Holzmann firm (FRG) completed the work in 430 working days, 40 percent of the work being done by Hungarians, at the cost set in the contract. The three story complex with a total of 6,500 square meters consists of two buildings which look the same to an outside observer joined at their corners, which is also the reception area. (Four million dollars could be invested in instruments.)

There is no kitchen, dining room or buffet in the building; these are at the university. There is a 400 square meter library with computerized records, a theme search service and selected reader workstations. The building has modular installations, a piping network in the corridors and an easily transformed internal wall system. There is a 1,000 square meter laboratory in each block with air conditioning and maximal area and technical flexibility. Each has two "cold" rooms, one "C" level isotope laboratory, autoclave and centrifuge room and last but not least a small conference area. On the roof of each unit there is a 1,200 square meter computer controlled "greenhouse" or "animal house" satisfying virtually every need.

The technical parameters of the "greenhouse" include the heat insulating capacity of the glass roofs, Kc = 3.1, the strength of the artificial light, 24,000 lux per square meter (for comparison, sunlight is 100,000 lux per square meter), the in-house neutralization of contaminated water coming from isotope treatments, an independent water pressure system, and water purification to provide ion exchanged water for sterile soils through a network.

On the upper floors of the building are areas for the refrigeration machinery, a 780,000 kcal/h heating capacity steam boiler and the elevator machinery. The institute is provided with electric power by 2 x 1,600 kVA transformers.

Four independently accounting research sections perform the research activity of the institute. Two of these deal with basic research—Section I under Dr. Laszlo Orosz deals with genetics and Section II under Dr. Sandor Pongor deals with biochemistry. In the applied research area Section III under Dr. Bencze Aschboth deals with biotechnology and Section IV under Dr. Ervin Balazs deals with plant biotechnology or biology.

Without trying to be complete the chief research areas are given below.

Sections I and II

In the area of molecular genetics, building in a growth hormone, for example in carp, in order to produce more economical food; "transplanting" the gluten content of wheat into rice so it can be used as a fuller foodstuff; and computerized protein design and "building in" protein into potatoes also to produce a fuller foodstuff.

Section III

As a result of gene splicing intervention in embryo manipulation one can expect transgenic rabbits where the building in of the growth hormone gets into the rabbit milk; a stressed task is veterinary diagnostics with the development of monochromal antibodies.

Section IV

Increasing the effectiveness of feeding is a basic task, wild and cultivated plants—in vitro growing—that is, producing a complete plant from every plant cell, for example for sugar beets, potatoes, oil rape, sunflowers, and rice. Within the framework of lasting protection of the foodstuffs or fodder produced the genetic study of pathogenic fungi because the fusarium fungi infects the plants, producing microtoxins, various diseases, causing lasting damage to humans and animals, similar to human estrogens. Filtering them out is a gigantic task possible only with RFLP technology.

The tools available to the researchers include a central WAX-2 computer which is linked to a computer at the Heidelberg Research Center and which communicates more loosely with thirtytwo 286 based terminals within the institute; via the SZTAKI [Computer Technology and Automation Research Institute] it maintains contact with the IIF [National Research and Development Network]. The "high technology" also includes a gas chromatograph, a mass spectrograph and an ultracentrifuge capable of reaching 600,000 G with which they can do peptide synthesis. The visitors concluded that the Agricultural Biotechnology Research Center in Godollo represents peak technology as a project and in terms of the tools available. The tasks they have set themselves—

although somewhat removed from those of the visitors—are tasks of world importance, ensuring a better supply of food to mankind, and this coincides with the way out imagined, with structural change.

We congratulate them for the results achieved, we wish them much success in their work, and we hope that the institute will have an opportunity to realize its residential site which will make possible the tranquil, successful work of its own and guest researchers.

Hungarian Data Collection System Described

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[Article by Kalman Balajthy, Sandor Horanyi, and Laszlo Koveshegyi of the Central Physics Research Institute (KFKI): "A Computerized Data Collection System for the Research Reactor of the KFKI"]

[Text] Following reconstruction, the research reactor of the KFKI is expected to begin working again this year. The article describes the chief parameters of the research reactor, the structure of the data collection computer system, its tasks and services, and the experiences in putting it into operation.

The VVER-Sz research reactor of the Central Physics Research Institute was put into operation in 1959. In 1967, as the result of a minor reconstruction, its original two MW output was increased to five MW. Another reconstruction was decided upon in 1982. The goal of this was to attain 10 MW (later 20 MW) thermal output and the associated high thermal neutron flux level. In the course of the reconstruction they built a new reactor tank and a new two-cycle cooling system and all the mechanical, control safety and radiation safety systems were renovated. Development of a computerized measurement data collection system was part of the reconstruction. This primarily aids the work of the operators performing operations but it also provides data for maintenance, isotope manufacture and the measurements of the physicists.

The reactor is suitable for both research and isotope manufacturing tasks. The length of a single operation cycle is 40 days; five cycles per year are planned. The chief parameters of the reactor are given below:

- Thermal neutron flux in the reflector—max. 1.8 x 10^{14} n/cm^2 s
- Thermal neutron flux in the neutron traps—2.3 x 10^{14} n/cm^2 s
- Thermal power—10 MW (planned)
- Heat capacity of the cooling system at 27.5 degrees Celsius calibration air temperature—20 MW
- Number of fuel element bundles (starting zone)—132
- Control and safety rods—18
- Number of horizontal channels—eight plus two
- Number of vertical irradiation channels—42
- Number of capsules which can be irradiated at once—200 to 250
- Fuel—36 percent enriched metalic uranium
- Average output and input temperature of the primary cycle at nominal operation—60/50 degrees Celsius
- Length of balance campaign—40 days.

Increasing the Safety of the Reactor

The formation of the reactor, its operating principle, and its nuclear and thermal technology parameters rule out in advance the possibility of a serious nuclear accident. Safety and accident systems were developed in the interest of preventing radioactive materials reaching the environment in the course of failures or accidents. These systems work independently of one another according to different physical principles, and they contain multiple redundancies. With their aid the cooling of the reactor zone can be ensured under all circumstances and radioactive materials can be prevented from getting into the environment.

The more important mechanical, measurement, and control equipment of the reactor contain multiple redundancies.

Three logical control units evaluate the critical signals in parallel. The safety logic shoots the safety rods into the zone, shutting down the nuclear process, if failure signals are noted or if there is a bilateral voltage failure.

Control of reactor output, its safety logic, and its measurement, signalling, and control systems operate independently of the data collection computer.

The task of the data collection computer is primarily to handle together the large number of signals thus making possible the fast informing of the operators, a fast review of the subsystems and their interdependencies, aiding human decisions with a determination of parameters which can be imagined only with computer technology tools. The chief tasks of the computer are the following:

1. Data collection—128 analog and 276 two-state process signals;
2. Generating computed parameters, there are now about 80 of these;
3. Event and failure record keeping;
4. Preparing an operational journal;
5. Continual determination of integrated radioactive emission values on the basis of dosimetric and air exchange measurements, giving an alarm if limit values are exceeded;

6. Supporting tasks connected with operations, e.g., determining zone poisoning, computing rod values, computing power days, etc.;
7. Informing operators about the momentary status of parameters and their development over time;
8. Giving operations advice—listing the conditions for starting or stopping the several technological units, indicating the current values;
9. Failure analyses, analysis of reactor shut-downs;
10. Isotope record keeping, administration for irradiations;
11. Providing data for control and calibration of the experiments and measurements of reactor users.

Configuration of the Computer

The TPA 11/510 computer is connected through a CAMAC process peripheral to the instrumentation of the reactor. It receives the analog and two-state signals and has contact outputs.

The measured and computed data are displayed on color graphic VT340 terminals or IBM AT compatible PC's. Two matrix printers print out the journals.

The computer has 9 Mbytes central memory, a 130 Mbyte Winchester disk, a magnetic tape unit and one 5 ¼ inch floppy. It is connected to various PC based measurement and experiment devices through RS-232 lines.

Computerized Data Collection

The computer is connected to 276 two-state and 128 analog measurements. This is about one third of all the signals and almost all of the analog signals.

A change in any of the two-state signals causes an interrupt request. As prescribed the changes go onto an event journal. A credibility test is made on signals which belong together. The maximal frequency of signal changes which can be handled is about 27 journal recorded changes per second.

The analog signals are measured with a relay multiplexer and an integrating A/D converter with an integration time of 20 ms. The polling cycle for the slowly changing parameters is 30 s. The cycle for dosimetric (radiation check) and nuclear signals is 5 and 1 s respectively. Computed parameters, about 80 of them, are determined every second from the measured signals.

There is a credibility and optional limit value test for every analog parameter. Table instruments displaying the analog signals generate, independent of the computer, the limit values important for the operation of the reactor; these go to the computer or to the independent failure indicator and safety logic systems as two-state signals.

The signal changes to be entered in the journal, the exceeding of limit values, etc. go into the event journal in the order that they are observed. The time marker in this has a resolution of 16.6 ms.

The measured and computed values can be called up for 2.5 hours with a resolution of 1 s, for 2.5 days with a resolution of 30 s and for 50 days with a resolution of one hour (rough clock values).

Journal Keeping Tasks

The shift journal is printed out four times per day. Its parts are:

- A data journal—contains momentary values of the parameters broken down by hours;
- An event journal—contains the signals and events for the given six hours in time order;
- List of disallowed signals—signals incredible or faulty at time of printing;
- Isotope production journal—contains operations connected with isotope production.

The shift journals are stored on disk and can be printed from there again at any time.

There are two printers in the reactor control room. The operator can select which one to use for automatic journal keeping and he can disallow or reinitiate printing.

Data Display

The data available in the computer can be reviewed by the operator on two color graphic VT340 terminals in the control room. A single keyboard operates both screens. One screen is active, the commands go to it, the other is passive, the data of the image called earlier are constantly refreshed on it. Naturally the active screen also is refreshed between giving two image display commands.

The time, the momentary thermal output of the reactor and data used to display trends are refreshed with a frequency of one second. The other momentary values are refreshed every five seconds. Analog values are displayed as numbers or in the form of a column diagram; signals are displayed with a symbol or as 0/1 numbers, with the time of last change.

Operator dialog is by menu control or by giving the serial number of the menu points. A help image pertaining to the given phase of the dialog can be called up at any time by pushing a single key. Since a printer is not tied to the terminals "logic" hard copy can be prepared on one of the control room printers, and this is also stored on disk.

The operators can choose among the following tasks on the terminals:

- display of schema diagrams—graphic diagrams, refreshed momentary values;
- trend data—graphic display of stored data in a prescribed temporal breakdown; scaling, window selection, and point-by-point querying are possible; trend display of momentary values;
- tabular data display—refreshed momentary values;
- informational data—in Hungarian, German and English languages;
- querying events—current day or archive, all signals or only certain signals or signal groups;
- start/stop conditions—a tree structured check list; also shows refreshed momentary values;
- records on isotope production data—by capsules and irradiation channels, observing irradiation duration;
- operator interventions—controlling and starting printing and display, archiving data, controlling measurement and data collection.

The events roll past in the lower lines of the operator terminals. Messages pertaining to failures and other messages (predictive, operational, etc.) can be divided up between the two screens.

The data display services of the operator's terminal can also be accessed from the PC terminals located in various places in the reactor building. But one cannot give from these terminals commands which influence data collection or printing. The PC's may have their own printers and graphic hard copy is possible on them.

These same PC's serve maintenance of the system and program development, but this is possible only if you know the necessary password.

A separate PC serves to prepare data on isotope production. This computer can process the data in terminal mode, can make repeated queries, and in the local PC mode it keeps records on the fissioning material.

Data Archiving

When the reactor is shut down all the measured and computed data for the three minutes preceding and one minute following the shutdown are automatically recorded with a resolution of one second. The operator also has the possibility of recording at any time data of a time slice consisting of 240 points; this is stored on disk and can be analyzed subsequently.

The event files collected daily, the four daily shift journals, the recorded time slices and the logical hard copy prepared on the operator's terminal constitute the operational data of the reactor. At the end of each reactor cycle (campaign) these are archived on magnetic tape by periods of about 40-50 days. The disk capacity permits simultaneous storage of data for two to three campaigns.

The archived data can be selectively reloaded for purposes of later analysis and can be queried on the PC terminals. This permits retroactive fault analysis for several years.

The Program System

The operating system of the computer permits simultaneous event controlled and time controlled running of several programs on the basis of fixed and changing priorities.

The user programs are written in the FORTRAN language; this ensured the shortest development time. The system routines which can be called from the FORTRAN language make possible the use of all necessary services of the operating system from synchronization of the programs through use of distributed databases to management of the process peripherals.

The program system was developed in such a way that all possible applictions specific data can be found in separate data files. So the maintenance and expansion of these does not require any special programming expertise.

Experiences of Putting It Into Operation

The development of the computer system began in mid-1988. It was installed 6 months later. The first version of the complete program system was prepared by the fall of 1989. Only the basic measurement and display subprograms were prepared prior to installation (in six months, together with the system plan). The programs providing the display and operator surface were prepared on site. This made it possible to discuss all problems immediately with the ultimate users (the operators). This helped to bridge the gap between the computer experts and the users with less computer training, avoiding solutions which did not satisfy real needs.

Mastering operation of the system and use of the finished parts began immediately after installation. Mastering operation, even without any prior computer training, took no more than a few hours. The services of the computer were relied upon greatly even during the start up of the reactor and the testing of its subsystems.

On the basis of operational tests a further development plan was prepared. This contains an increase in the number of process signals and a slight expansion of services; another goal is computerized control of the compensating rods thus far controlled by hand to ensure that the automatic control rods always work in a linear section of the control domain.

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